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BY

GILBERT PERCY WHITLEY,
Ichthyologist, The Australian Museum, Sydney

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WITH FIVE TEXT-FIGURES AND FOUR PLATES

INTRODUCTION 267
HISTORICAL 268
SYSTEMATIC ACCOUNT 269
INDEX 313

INTRODUCTION.

A CHECK-LIST of the fishes of Queensland, Australia, was published by McCulloch and Whitley in 1925 (Mem. Qd. Mus., VIII, p. 125), and in a recent paper (Mem. Qd. Mus. X, 1930, p. 8) I have brought the list as up-to-date as possible. The present contribution to Queensland ichthyology arises from the basis provided by those papers, and by McCulloch's "Check-List" (Mem. Aust. Mus. V, 1929) which should be studied in connection with this Report.

The specimens discussed in the following pages were obtained at Low Isles or Batt Reef, North Queensland, under the auspices of the Great Barrier Reef Expedition, being mostly collected by the author. To various members of the Expedition and to Mr. W. Boardman of the Australian Museum are due thanks for collaboration in making this collection. Over 350 specimens of fishes were secured, and these are here referred to nearly a hundred species. The greater part of this collection will be consigned to the British Museum (Natural History). Details of the synonymy of well-known species have not been tabulated in order to save space, and only specially relevant references to literature have been included. I have tried to lighten the burden of synonymy in the papers quoted above and in my recent papers in the Records of the Australian Museum and the Australian Zoologist.

It is customary, in a report of this kind, to give a list of species, followed by tabulated symbols indicating their geographical or bathymetrical distribution. Whilst this has been attempted, it has not been considered worthy of publication, as the range of the fishes of the Indo-Australian and Pacific regions is still not sufficiently analysed for such a synthesis to be made. The Low Isles fishes are typically Solanderian forms.* Some of the species mentioned here are newly recorded from Queensland or even Australia, and it is still easy for any Australian collector to add new species to our knowledge from the superabundant fish-fauna of Queensland and other northern Australian waters.

Acknowledgments are gladly tendered to the leader and members of the Great Barrier Reef Expedition for facilities afforded for collecting, observing, and finally reporting on the fishes of Low Isles and vicinity. To my colleague, Mr. William Boardman, who accompanied me to Low Isles as a guest of the Expedition, I am indebted for photographs of various species of fishes in their natural environment and for much help in collecting them. Mr. H. A. Longman, Director of the Queensland Museum, and Mr. J. Shewan, Curator of the Macleay Museum, University of Sydney, kindly lent typical or unique specimens of fishes from the collections in their care for study and comparison with the Low Isles series. The half-tone illustrations for this paper have been kindly prepared by Miss Joyce K. Allan. The black and white drawings are the work of the writer.

HISTORICAL.

Low Isles had apparently been visited by but few collectors prior to 1928.

Huxley and Macgillivray, of the "Rattlesnake," were the first naturalists to land at Low Isles, in 1848. John Macgillivray (Narr. Voy. Rattlesnake, I, 1852, pp. 101–103) remarked: "On July 7th [1848] we anchored to leeward of the Low Isles . . . Many kinds of fishes, *Muraena*, *Diodon*, *Balistes*, *Serranus*, etc., are found in the pools among the coral blocks."

Sir William Macleay in the "Chevert" visited Low Isles, but authors of papers on the Queensland marine fauna have wrongly recorded his specimens from Torres Strait. That the "Chevert" was at the Low Isles off Port Douglas is evident from contemporary accounts which I have consulted in the Mitchell Library, Sydney. Macleay himself wrote in one of these (Sydney Morning Herald, 16th October, 1875, p. 487):

> "On the next day [June 6th, 1875] we anchored early off a low wooded sandbank, marked on the chart "Low Wooded Isle." It was surrounded by an extensive coral reef . . . the whole reef was literally teeming with life—fish in great variety, Crustacea, Echinoderms including several species of beche-de-mer, corals and annelids."

Some fishes were collected by members of the "Chevert" Expedition, and the various species were recorded from Low Isles by Alleyne and Macleay in the early part of the Proceedings of the Linnean Society of New South Wales.

A series of Low Isles fishes was obtained by my late friend, W. E. J. Paradice, in 1923, when he was Surgeon-Lieutenant on H.M.A.S. "Geranium." These specimens are preserved in the Australian Museum and have been recorded in this report.

Non-technical accounts of some of the fishes of the British Great Barrier Reef Expedition have been given by Tandy in Natural History Magazine, II, 1929, by Whitley and Boardman in The Australian Museum Magazine, III, 1929, and by Yonge (A Year on the Great Barrier Reef, published 10th November, 1930).

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* Hedley, Proc. Linn. Soc. N.S.W. XXVIII, 1903 (published 28th April, 1904), p. 880.

SYSTEMATIC ACCOUNT.

Family Hemiscylliidae.

Genus *Hemiscyllium*, Müller and Henle, 1838.

Hemiscyllium ocellatum (Bonnaterre).

This species is very common in shallow waters of the Great Barrier Reef and was one of the first fishes to be described from what is now Queensland. It was occasionally met with under boulders on the reef flat near Madrepore Moat, Low Isles. One specimen preserved; Australian Museum registered number IA.4485. A 3-ft. specimen captured among mangrove (*Rhizophora*) roots had the right ocellus normal, but the left was a mere irregularly defined blackish area.

Family Dasyatidae.

Genus *Taeniura*, Müller and Henle, 1837.

Taeniura lymnia halgani (Lesson).

Taeniura lymnia halgani, Whitley, Rec. Aust. Mus. XVIII, 25th March, 1931, p. 97, pl. xi (references and synonymy).

The commonest Sting Ray at Low Isles. One specimen caught at Batt Reef had eaten prawns, mantis shrimps and polychaete worms.

Genus *Himantura*, Müller and Henle, 1837.

Himantura granulata (Macleay).

(Plate I, fig. 1).

A specimen seen amongst mangrove roots (28th August). It lay motionless on the mud, and was difficult to distinguish from its shadowy surroundings. Others were seen at different times, showing that this species, which had not at that time been recorded from Australia, was fairly common at Low Isles.

A fine specimen (IA.4477) was caught in a creek amongst mangroves on 19th September, 1928. This agrees well with my account of *Himantura granulata* (Rec. Aust. Mus. XVI, 1928, p. 211, figs. 1, 2), but the ventral surface has series of brownish blotches disposed in roughly symmetrical rows on each side, as well as broad brownish-grey margins. Sex—female; stomach contained small crabs and prawns.

Colours when Fresh.—Dark olive-greyish on back, with a few scattered white spots, not forming ocelli or marks like those in Jordan and Seale's figure of *Himantura fai*. Pupil black, enclosed in a whitish ring and surrounded by smoky grey; the eye is outlined with blackish, and has a light grey "eyelid" which does not form a flap.

The eyes protrude laterally. In my figure of a long-preserved specimen they are represented as sunken in the sockets. The wrinkles around the mouth are probably also largely the result of methods of preservation.

Family STOLEPHORIDAE.

Genus *Stolephorus*, Lacepède, 1803.

Stolephorus robustus (Ogilby).

Three young specimens (IA.4470), tow-netted at night, September, 1928, are apparently referable to this species.

Family CLUPEIDAE.

Genus *Harengula*, Cuvier and Valenciennes, 1847.

Harengula punctata (Rüppell).

One (IA.4459) in the Australian Museum from Low Isles, 30th September, 1928, compared with three (I.4581) in the Queensland Museum from the same locality.

Clupea profundis, *C. ranelayi* and *C. torresiensis*, Saville-Kent, may be relegated to the synonymy of this species. All these are *nomina nuda* taken from the manuscripts of De Vis; they were also listed in Saville-Kent's The Great Barrier Reef of Australia, p. 370.

The type of *C. ranelayi* is 31 mm. long, and is preserved in the Queensland Museum. Specimens labelled *C. torresiensis* are in the Queensland and Australian Museums. The type of *C. profunda* (*sic*) is in the Australian Museum.

Family OPHICHTHIIDAE.

Genus *Zonophichthus*, Whitley, 1930.

Zonophichthus marginatus (Bleeker).

One (IA.4491) from Low Isles agrees with Bleeker's figure of *Ophichthys cephalozona*; I have not seen Bleeker's original description of *Muraenopsis marginatus*, but do not regard it as invalidated by *Ophisurus marginatus* Peters, as the two species are evidently not congeneric.

LIFE COLOURS.—General colour greyish brown, darkest dorsally; dirty white ventrally. A whitish band across the nape is followed by a prominent, broad, saddle-shaped band of very dark brown, and this is bordered posteriorly by another whitish band which encircles the fish at the pectorals and a little before the dorsal. Pupil black, rest of eye olivaceous. The rims of the mucus-pores on the head and body are brown. Dorsal greyish near base, becoming darker inframarginally, but bordered by strongly contrasted white. Anal similar to dorsal. End of tail fading to whitish with the extreme tip pink.

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Vent and genital aperture brownish. Pectoral yellow, with a white border, darker on its inner surface.

Occasionally seen swimming in shallow water over coral in reef flat.

Family MURAENIDAE.

Genus *Echidna*, Forster, 1788.

Echidna nebulosa (Thunberg).

One (IA.4087) from Low Isles under stone, 15th September; two (IA.4088) from Snapper Island and one old specimen (IA.4058) from Batt Reef. Deraniyagala has erroneously included "South Australia" in the range of this common tropical species, but it is doubtful whether it crosses the border of Queensland and New South Wales. An ancient figure, which seems to represent this species, has been given by Valentyn (Amboina, III, 1726, p. 460, fig. 364).

Genus *Gymnothorax*, Bloch, 1795.

Gymnothorax cancellatus (Richardson).

Muraena cancellata, Richardson, Zool. Voy. "Erebus" and "Terror," Fish, 1848, p. 87, pl. xlvi, figs. 1–5. West Australia (type-loc.); Cape Upstart, Queensland; and Sumatra. Types in British Museum.
Thyrsoidea cancellata, Kaup, Cat. Apodal Fish Brit. Mus. 1856, p. 76, fig 59 (type).
Gymnothorax cancellatus, Bleeker, Atlas Ichth. IV, 1864, p. 93, pl. clxxv, fig. 3 (East Indies).
Muraena cancellata, Macleay, Proc. Linn. Soc. N.S.W. VIII, 1883, p. 278 (Hood Bay, New Guinea).

One specimen from Low Isles (IA.4056).

Weber and Beaufort regard this form as identical with *Gymnothorax undulatus* (Lacepède), but, as my specimen agrees better with the figures of Richardson and Bleeker, I am using the name *cancellatus* for it. The colours of the Western Australian typical form are more diffuse than in the Queensland specimen, but it seems inadvisable to give a new name to the latter. Fowler (Mem. Bishop Mus. X, 1928, pp. 56, 57) has given a long list of nominal synonyms of *Lycodontis* (= *Gymnothorax*) *undulata* (Lacepède).

Gymnothorax melanospilos (Bleeker).

One specimen (IA.4052) from Low Isles, whose head has been figured in the Aust. Mus. Mag. iv, 1930, p. 98.

LIFE COLOURS.—Ground-colour light greenish grey on back, sides, and dorsal fin; lighter and suffused with pinkish below. Top of head dark greenish; chin brown. A number of irregular dark brown spots on head, body, and dorsal fin. Anal whitish. Eye blue, with a coppery ring; iris greyish. Grooves on throat brown. Jaws white; rictus dark brown. Inner parts of mouth brown.

Genus *Anarchias*, Jordan and Seale, 1906.

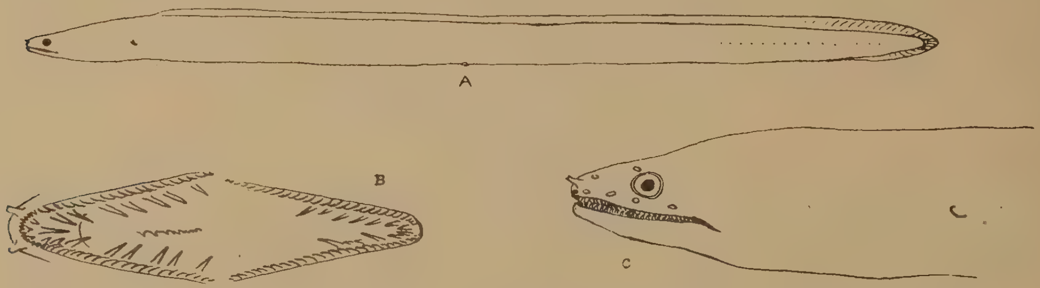
Anarchias, Jordan and Seale, Bull. U.S. Bur. Fish XXV, 1905 (1906), p. 204.

This genus, whose name must not be confused with the variants of *Anarhichas*, Linnaeus, is distinguished from *Gymnothorax* by having the anal fin atrophied anteriorly. It has not before been recognized from Australia, having been recorded only from Samoa and the Philippine Islands. There is, however, a New Hebrides specimen of *A. knighti*, Jordan and Seale, in the Australian Museum, so that the range of the genus is now considerably extended.

Anarchias insuetus, sp. n.

Head (21·5 mm.) 8·6, depth (9) about 20 in total length (185). Interorbital subequal to eye (2), 1·5 in snout (3). Gape (8) 2·7 in head. Head and body (90) shorter than tail (95).

Profile of head oblique. Snout rounded. Upper jaw slightly longer than lower. Eye small, round, enveloped in skin. Anterior nostrils in the form of short tapering tubes. Posterior nostrils circular, without an elevated rim.



Text-fig. 1.—*Anarchias insuetus*, sp. n. Holotype from Low Isles. Regd. no. IA.4458. A. The entire specimen. B. Dentition (enlarged). C. Head (enlarged). Drawings by Gilbert P. Whitley.

Four large subelliptical pores along the margin of the upper jaw. Two similar pores on the interorbital, one over the anterior half of each eye. Gill openings small, lateral, rising obliquely upward and forward.

Gape large, extending almost as much behind the eye as it does before it. All the teeth are more or less movable. A single series of small hinged inter-maxillary teeth with a small mesial tooth and a large depressible fang on the intermaxillary plate. An outer row of short, curved, pointed teeth in a single series on each maxillary, flanked by an inner row of about seven long, depressible fangs. A single series of about seven depressible teeth on the vomer, which forms a ridge. Mandible with an outer row of close-set, curved teeth and a group of fang-like teeth behind the symphysis. Several depressible fangs, on each side of the mandible, inside the outer row of smaller teeth. These were probably originally symmetrical, but some small recumbent teeth in the present example suggest that replacement of broken ones is taking place.

General form of body elongate, rather compressed. The trunk is three times the length of the head, and the tail is longer than the head and trunk combined. Integument smooth, tough. Lateral line with small, spaced pores. Dorsal fin originating a short distance behind head and continuing as a low, fleshy fold to the tip of the tail, where it is indistinguishable externally from the minute caudal fin. Anal fin atrophied anteriorly, appearing as a low fold posteriorly, where it joins the caudal in a similar manner to the posterior portion of the dorsal fin. Weak fin-rays can only be discerned around the tip of the tail.

General colour, in alcohol, dark olive brown, becoming tinged in places with yellowish, especially on the lower part of the head and body, and becoming still lighter on the lips. Dorsal, caudal, and anal blackish. No spots. No black mark around gill-openings.

Described and figured from the holotype, a somewhat shrivelled specimen, 185 mm. long, from Low Isles, off Port Douglas, Queensland.

Australian Museum registered number IA.4458.

This new species appears to differ from its congeners in the shape of the head, the disposition of its teeth, and in having a fairly uniform coloration.

Genus *Siderea*, Kaup, 1856.

Siderea picta (Thunberg).

One large specimen (IA.4489) from the reef flat at Low Isles agrees with Weber and Beaufort's fig. 183c (Fish. Indo-Austral. Arch. III, 1916). This species was commonly seen swimming over coral ; it generally leaned to one side and kept the mouth wide open, and is probably the kind of which MacGillivray (Narr. Voy. Rattlesnake, I, 1852, p. 102) had such unpleasant experience.

Genus *Uropterygius*, Rüppell, 1838.

Uropterygius marmoratus (Lacepède)

One (IA.4490) from Low Isles ; wriggling, head or tail first, amongst coral debris. A common Indo-Pacific species not hitherto noticed from Queensland.

Life Colours.—Ground-colour creamy white, almost covered by light and dark brown blotches which are more densely crowded near the dorsal surface. Dorsal and anal fins imperceptible, even the tip of the tail being fleshy. Vent dark bluish. Pupil black, surrounded by a coppery ring ; iris light violet.

Family Fistulariidae.

Genus *Fistularia*, Linnaeus, 1758.

Fistularia petimba, Lacepède.

A specimen seen early one morning inshore changed colour, when disturbed by a nearby school of fishes, from uniform cigar-brown to sandy-coloured bars alternating with dark brown bands irregularly broken by lighter.

I have examined a specimen from Low Isles in the Queensland Museum, Brisbane.

Family Syngnathidae.

Genus *Hippichthys*, Bleeker, 1849.

Hippichthys, Bleeker, Verh. Batavia Genoot. XXII, 1849 (Ichth. Faun. Madura), p. 15. Genotype, *H. heptagonus*, Blkr.

? *Corythoichthys*, Kaup, Archiv Naturgesch. (Wiegmann), XIX, 1, 1853, p. 231 ; Cat. Lophobr. Fish Brit. Mus. 1856, p. 25. Genotype, *C. albirostris*, Kaup, selected by Jordan and Evermann, Rept. U.S. Comm. Fish 1895 (28th December, 1896), appendix 5, p. 328, where the name is spelt *Corythroichthys*.

Corythoichthys, Duncker, In Michaelsen and Hartmeyer, Faun. S.W. Austr. Bd. II, lief. 15, 1909 p. 237; Jahrb. Hamburg Wiss. Anst. XXIX, 1912, p 232. *Non sensu stricto.* Genotype regarded by Duncker as *Syngnathus conspicillatus* Jenyns.

In diagnosing *Hippichthys*, Bleeker remarked that it had no anal fin. This fin is minute and sometimes difficult to see in species of the genus called *Corythoichthys* by writers on Indo-Pacific Syngnathidae, and as, apart from this discrepancy, Bleeker's description applies to the Pipe-fishes described below, his generic name may be employed.

Subgenus *Bhanotichthys*, Parr, 1930.

Bhanotichthys, Parr, Bull. Bingham Oceanogr. Coll. III, 1930. Genotype, *Syngnathus fasciatus*, Gray.

Hippichthys (*Bhanotichthys*) *intestinalis* (Ramsay).

Syngnat(h)us intestinalis, Ramsay, Proc. Linn. Soc. N.S.W. V, 20th May 1881, p. 494. No locality (= Duke of York Island and Bougainville I., Solomons). Types in Austr. Mus., Sydney, examined; Boulenger, Cambr. Nat. Hist. 1904, p. 635.

Corythroichthys waitei, McCulloch, Abstr. Proc. Linn. Soc. N.S.W., No. 285, July, 1910 (Cairns Reef, off Cooktown, Queensland).

Corythroichthys intestinalis, McCulloch, Zool. Res. "Endeavour," I, 1911, p. 26; Ogilby, Mem. Qd. Mus. II, 1913, p. 90.

? *Corythoichthys fasciatus*, Duncker and Mohr, Mitt. Zool. Mus. Hamburg, XLI, 1925, p. 108 (New Guinea, New Mecklenburg, New Pomerania). Not *Syngnathus fasciatus*, Gray, Illust. Indian Zool. I, October, 1830, pl. lxxxix, preoccupied by *S. fasciatus*, Risso, Ichthyol. Nice, 1810, p. 70.

Corythoichthys flavofasciatus, Fowler, Mem. Bishop Mus. X, 1928, p. 113 (Pacific localities); McCulloch, Mem. Aust. Mus. V, 1929, p. 87. Not *Syngnathus flavofasciatus*, Rüppell, Neue Wirbelth. Abyssin. Fische, 1838, p. 144.

D. 28; A. 2; P. 16; C. 8. Osseous rings 16 + 33.

Head (14·5 mm.) 9·3 in total length (134). Depth (5) 6·4 in trunk (32), which is 2·4 in tail including caudal (76). Length of caudal (4) 3 in base of dorsal (12). Length of pectoral (3) equals longitudinal diameter of orbit (3), 2 in snout (6), which is a trifle longer than posterior portion of head (5·5).

Body elongate, seven-cornered in transverse section, deepest before the dorsal. Tail tapering, four-cornered in cross-section. Dorso-lateral ridges of body and tail not continuous. Lateral ridges of body ceasing on the ring before that on which the dorso-lateral ridges of the tail commence.

Ventro-lateral ridges of body and tail continuous. A weak median keel on body ventrally. Brood pouch on anterior ten tail-rings, but ventral flaps extend still farther back.

Mouth small; snout keeled above. Eyes large, with concave interorbital. A transverse keel on the operculum, which is also pitted. A pair of crests above and behind eyes; three median crests on nape. No serrations on crests.

Dorsal originating behind vertical of anus, its base not raised. Anal fin minute. Caudal with thick pointed rays.

Straw-coloured, suffused with pinkish, crossed by about seventeen patches of blackish reticulations which break into pairs posteriorly. A few blackish reticulations on head, back, and flaps of brood pouch; none on ventral surface. A short brown stripe below opercular ridge, a darker one extending along posterior half of snout, below eye, to lower part of operculum. Several small dark brown blotches on isthmus and three larger ones on ventral surface of first three body-rings.

Described from one of three specimens, $4\frac{3}{4}$ to 5 in. long, collected at Batt Reef, Queensland, 13th September, 1928; where the species was commonly seen lying on the sand, but would wriggle into weed or under stones when disturbed. Registered Nos. IA.4059 (described specimen) and 4060 (2 specs.). Another (IA.4469) from coral in moat at Low Isles.

This species is listed from Australia as *Corythoichthys flavofasciatus*, Rüppell (McCulloch, Mem. Aust. Mus. V, 1929, p. 87), but as that is a Red Sea species, it seems doubtful whether the Australian form is conspecific. I have compared Queensland specimens with the types of *Syngnathus intestinalis*, Ramsay, in the Australian Museum, and find they agree excellently.

Corythroichthys sealei, Jordan and Seale (Seale, Occ. Pap. Bishop Mus. IV, 1, 1906, p. 17 *nom. nud.;* Jordan and Seale, Bull. U.S. Bur. Fish. XXV, 1906, p. 213, fig. 18, Apia, Samoa), has two broad blackish bands on each side of head and blotches on body not nearly so densely reticulated. Specimens of this species were collected for the Australian Museum at Pango Pango, Samoa, by Charles Hedley. *Corythroichthys waitei* of the same authors has apparently different formula and denser colour-markings.

Duncker (Jahrb. Hamburg. Wiss. Aust. XXXII, 1915, p. 72) and Weber and Beaufort (Fish. Indo-Austr. Archip. IV, 1922, p. 70, fig. 31) unite these forms with the Indian *C. fasciatus* (Gray) (a preoccupied name), whilst noting that the Pacific form has a shorter and more slender snout.

Günther (J. Mus. Godeffroy, VI, 17 [Fische Südsee, IX], 1910, p. 431, pl. clxvii, fig. c) records "*Syngnathus haematopterus*" from New South Wales, but I very much doubt whether its range extends so far southward. Probably Günther thought Ramsay's unlocalized specimen came from this State. His figure shows a fish in which the dark transverse bands are fasciated rather than reticulated as in *Hippichthys intestinalis*.

Specimens of *Hippichthys intestinalis*, 2 to $6\frac{1}{2}$ in. long, are in the Australian Museum from Cairns Reef off Cooktown, Queensland; North Coast of Guadalcanar, and Bougainville I., Solomon Islands; New Britain; Fiji; Vila and Malekula, New Hebrides; Duke of York Island (from intestine of bêche-de-mer)—types of *Syngnathus intestinalis*, Ramsay.

Genus *Doryrhamphus*, Kaup, 1853.

Doryrhamphus melanopleura (Bleeker).

One (IA.2373) collected at Low Isles by Dr. W. E. J. Paradice.

Family BELONIDAE.

Genus *Strongylura*, Van Hasselt, 1823.

Strongylura terebra (Whitley).

Two specimens (IA.4090–1) from Low Isles, netted by lamplight at night, 8th September, 1928.

Tylosurus sp.

Large specimens, tentatively regarded as *Tylosurus*, were seen leaping from the water between Low Isles and Batt Reef but no specimens were secured.

Family HEMIRAMPHIDAE.

Genus *Farhians*, Whitley, 1930.

Farhians commersonii (Cuvier).

Esox marginatus var. b. *far*, Forskål, Descr. Anim. 1775, pp. xiii and 67, species 98, var. b. Vernacular name in a non-binomial work. Loheia, Red Sea.

Esox gladius var., Lacepède, Hist. Nat. Poiss. V, 1803, pp. 295 and 313, pl. vii, fig. 3. "Indies" (=East Indies). Type of *Hemiramphus commersonii*, Cuvier.

Hemiramphus commersonii, Cuvier, Règne Anim. ed. 2, II, April, 1829, p. 286, footnote 1. Based on Lacepède's figure (type locality, East Indies, designated by Whitley, Aust. Zool. VI, 1930, p. 250); Valenciennes, C. R. Acad. Sci. Paris, XXIII, August, 1846, p. 269; Cuvier and Valenciennes, Hist. Nat. Poiss. XIX, "1846" (= May, 1847), p. 28; ed. 2, p. 20; Alleyne and Macleay, Proc. Linn. Soc. N.S.W. I, 1877, p. 349 (Cape York, Queensland).

Hemiramphus far, Rüppell, Neue Wirbelth. Abyssin., Fische, 1837, p. 74 (Red Sea).

Hemiramphus moar, Thiollière, Ann. Agric. Soc. Lyon, VIII, 1856; Essai Faune Île Woodlark (Montrouzier), 1857, p. 205. Woodlark Island. Virtually a *nomen nudum*, regarded as equivalent to *H. far* by Fowler, Mem. Bishop Mus. X, 1928, p. 77.

Hemiramphus obesus, Castelnau, Mém. Poiss. Afr. Aust. 1861, p. 64. Port Natal, South Africa (*fide* Barnard, Ann. S. Afr. Mus. XXI, 1925, p. 262.)

Hemiramphus far, Bleeker, Atlas Ichth. VI, 1871, p. 54, pl. cclii, fig. 3, as *H. commersonii*, published 1869; Saville-Kent, Gt. Barrier Reef, 1893, pp. 299 and 370, pl. xlvii, fig. 2 (Queensland); Stead, Edible Fish, N.S. Wales, 1908, p. 37; Cockerell, Mem. Qd. Mus. II, 1913, p. 51 (scales); Boulenger, Cat. Freshw. Fish. Afr. III, 1915, p. 15, fig. 9; Weber and Beaufort, Fish. Indo-Austr. Archip. IV, 1922, p. 156, fig. 55 (references).

Farhians commersonii, Whitley, Aust. Zool. VI, 1931, p. 314 (N.S. Wales).

Three specimens caught offshore at Low Isles by Mr. F. S. Russell, using a trout fly, on 23rd August, 1928. One of these (IA.4480) is preserved in the Australian Museum, together with a specimen from the same locality (IA.1676) collected by Dr. Paradice.

LIFE COLOURS.—Back dark greenish-blue, each scale with a greyish border and some scales entirely grey. Sides of body brilliant silver with blue and green iridescence in some lights. Lateral band silvery white, margined above by a less definite blue band. Lower parts of body silvery white. Top of head greenish with peacock-blue reflections. Opercles and sides of head silvery with pink iridescence. Top of lower jaw brownish grey; its ventral surface orange, brighter towards tip, and the flaps orange margined with black. Pupil black, iris white; upper part of eye peacock green. Dorsal brilliant bluish green anteriorly, yellow tipped, and white posteriorly. Upper caudal lobe greenish with yellow tip; lower lobe blue. Pectorals, ventrals, and anal white. Axillary spot dark blue.

TAXONOMY.—I have been unable to trace in literature any acceptable usage, in true binomial fashion as a scientific name, of Forskål's Arabic vernacular name *Far*, before Rüppell employed it as a specific name in 1837. Bonnaterre (Tabl. Encycl. Meth., Ichth., 1788, p. 175) and Bory de Saint Vincent (Dict. Class, d'Hist. Nat. VI, 1824, p. 311) merely used *Far* in the vernacular, and Forskål's variety was not distinguished from *Esox marginatus* in either Gmelin's (1789) or Turton's (1806) editions of the Systema Naturae of

Linnaeus. *Hemiramphus commersonii*, Cuvier, is said to be conspecific with *H. far*, Rüppell, and as Cuvier's name has priority it must be used for this species.

I have designated "East Indies" as the type-locality of *H. commersonii*. If the Red Sea form be distinct, it should be known as *Farhians far* (Rüppell).

Genus *Zenarchopterus*, Gill, 1863.

Zenarchopterus dispar (Cuv. and Val).

D.11, its fourth ray produced into a hook. A.11, the sixth ray feather-like and nearly reaching end of caudal, and the seventh ray feather-like to a much less degree. P.10. Anal papilla mammiform. Upper jaw as long as broad.

A male (IA.4467), characterized above, and two females (IA.4468) from amongst mangroves, Low Isles, where the species was commonly seen swimming about the mangrove roots or floating at the surface of the clear water. These fishes are difficult to catch, but I secured my specimens by throwing sand at them and stunning them.

A larva (IA.4474) is apparently also referable to this species; it was found swimming amongst young mullet in the moat near the mangrove park.

Genus *Arrhamphus*, Günther, 1866.

Arrhamphus sclerolepis, Günther.

One (IA.4501) from Low Isles, 2nd September, 1928.

Family ATHERINIDAE.

Genus *Pranesus*, Whitley, 1930.

Pranesus ogilbyi, Whitley.

Atherina lacunosa, Alleyne and Macleay, Proc. Linn. Soc. N.S.W. I, 1877, p. 340 (Cape York ?). Not *Atherina lacunosa*, Bloch and Schneider, Syst. Ichth. 1801, p. 112.

Atherina pinguis, Alleyne and Macleay, Proc. Linn. Soc. N.S.W. I, 1877, p. 340 (Hall Sound, New Guinea). Not *Atherina pinguis*, Lacepède, Hist. Nat. Poiss. V, 1803, p. 372, pl. xi, fig. 1; Saville-Kent, Gt. Barrier Reef, 1893, pp. 293 and 370; Tosh, Parlm. Rept. Mar. Dept. Qd. 1902–3 (1903), p. 22, pl. xxii, fig. 8 (egg); Ogilby, Mem. Qd. Mus. I, 1912, pp. 37–38, pl. xii, fig. 1, and text-fig. *a*; Cockerell, Mem. Qd. Mus. II, 1913, p. 52 (scales).

Hepsetia pinguis, Jordan and Hubbs, Stud. Ichth. Monogr. Rev. Atherinidae, 1919, p. 32 (part); McCulloch and Whitley, Mem. Qd. Mus. VIII, 1925, p. 140; McCulloch, Mem. Aust. Mus. V, 1929, p. 109 (Queensland refs. only).

Pranesus ogilbyi, Whitley, Mem. Qd. Mus. X, 28th August, 1930, p. 9 (Moreton Bay, Queensland). Type in Queensland Museum.

Ogilby (1912) has given a good description of this species, of which the holotype is in the Queensland Museum.

On 29th August, 1928, the North-eastern Moat was in places densely crowded, at low water, by schools of these fishes or "Hardiheads," as they are called, which rushed madly in groups, often breaking the surface or even leaping out of the water. Sea-birds, sometimes harrassed by Frigate Birds, preyed on them from above. The terrified fishes sought shelter near coral blocks and even beside the boots of the writer, often colliding with his legs in their panic. They were then fairly easily caught with a hand-net. Later a Blacktip Shark began to feed on the fishes. The Hardiheads were also present in September, sometimes appearing in the Madrepore Moat, over rocks in the open sea nearby, or near the Crab Spit.

On 26th September these Atherines were very thick in the moats. In one open sheet of water leading into the mangroves the writer saw what looked like the shadow of a large tree on the water, but which on closer inspection resolved itself into a roughly diamond-shaped mass of Atherines, densely packed into an area of several square yards.

Four (I.4621–4624) in the Queensland Museum and ten (IA.4335–4337) in the Australian Museum from Low Isles.

Genus *Atherina*, Linnaeus, 1758.

Atherina lacunosa, Bloch and Schneider.

Four small specimens (IA.4464) from Low Isles.

Genus *Atherion*, Jordan and Starks, 1901.

Atherion maccullochi, Jordan and Hubbs.

This genus and species, characterized by the vent being near the anal fin and the lower part of head spiny, has not hitherto been recorded from Australia. One specimen (IA.2372), "caught a few yards from shore over a clean coral sand beach" by Dr. Paradice, and two specimens (IA.4472) 27–30 mm. in standard length, from Low Isles; caught at surface at night, 4th September, 1928. These have 42–43 transverse series of body-scales and 18–20 predorsal scales, eleven dorsal and sixteen anal rays, and have been compared with Lord Howe Island topotypes in the Australian Museum. *Atherina villosa*, Duncker and Mohr (Mitt. Zool. Mus. Hamburg, XLII, 1926, p. 135, fig. 10) is apparently congeneric.

Family MELANOTAENIIDAE.

Genus *Pseudomugil*, Kner, 1867.

Pseudomugil signatus (Günther).

Atherina signata, Günther, Ann. Mag. Nat. Hist. (3), XX, 1st July, 1867, p. 64. Cape York, Queensland (Damel). Type in British Museum; Macleay, Proc. Linn. Soc. N.S.W. VI, July, 1881, p. 40.

Pseudomugil signifer, McCulloch and Whitley, Mem. Qd. Mus. VIII, 1925, p. 140 (N. Queensland record only).

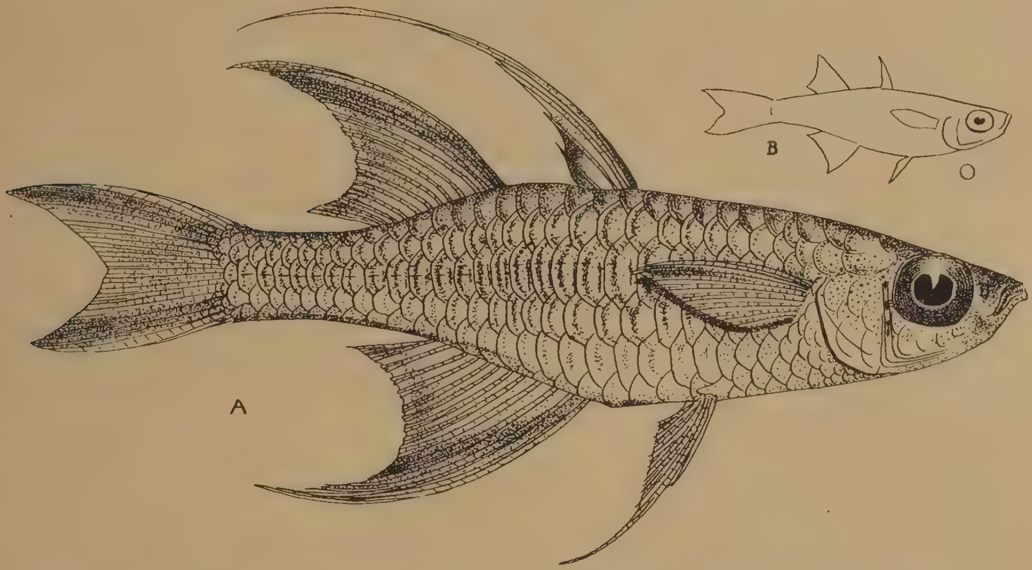
Pseudomugil signatus, Jordan and Hubbs, Stud. Ichth. Monogr. Rev. Atherinidae, 1919, p. 28.

In shallow water near mangrove roots were thousands of these little fishes, which could be netted as they swam in schools.

COLOURS IN LIFE.—Olivaceous above, each scale with a darker edge; becoming white on sides and belly. A brownish lateral band posteriorly and some blue spots on sides anteriorly. A median dark line along back. Head bluish-silvery with a red flush on operculum. Eye blue, with black pupil. First dorsal olivaceous, the spines darker. Second dorsal largely orange-yellow, with some anterior rays and their membranes blackish.

Anal rays smoky, the fin with a white margin. Median portion of caudal yellow; some upper and lower rays blackish with the top and bottom of the tail white-edged. Upper pectoral rays blackish, remainder of fin white (29th August, 1928).

Pseudomugil signatus is represented in the Australian Museum collections by ten specimens (I.9971) from freshwater near Townsville, Queensland, two (I.13634) from Dunk Island, and the series of forty-eight specimens (IA.4339-4343) from Low Isles noted above, of which a male (IA.4340) and a female (IA.4341) are here figured.



TEXT-FIG. 2.—*Pseudomugil signatus* (Günther). A. A male from Low Isles (much enlarged); regd. no. IA.4340. B. A female from Low Isles with one of its ova (enlarged); regd. no. IA.4341. Drawings by Gilbert P. Whitley.

This species is allied to *Pseudomugil novaeguinae*, Weber. It was wrongly united with *P. signifer*, Kner (Reise Novara, Zool. 1867, p. 275, pl. xiii, fig. 5), by Günther (Zool. Record, 1867 [1868] p. 166), but Kner's Sydney species is less ornate in coloration than the northern form.

Family MUGILIDAE.

Genus *Ellochelon*, Whitley, 1930.

Ellochelon vaigiensis (Quoy and Gaimard).

Two small specimens (IA.4465) from Low Isles, September, 1928. When swimming, the young appear to have a black-margined, saddle-shaped light area on the back, reminiscent of the markings of *Terapon servus*, but after death this colour-effect fades and the back becomes more regularly dusky.

All the specimens seen were of small size and swam in little schools, or in pairs, in the moats; they kept close together and sometimes congregated over hollows to feed upon matter in the sand (*cf.* Duncker and Mohr, Mitt. Zool. Mus. Hamburg, xlii, 1926, p. 131, figs. 4, 5).

Genus *Mugil*, Linnaeus, 1758.

Mugil delicatus, Alleyne and Macleay.

Mugil delicatus, Alleyne and Macleay, Proc. Linn. Soc. N.S.W. March, 1877, p. 341, pl. xv, fig. 1 (Cape York, Queensland). Types in Macleay Museum, University of Sydney.

D. iv/i, 8; A. ii/9; P. 17; V. i/5; C. 12.

Sc. 39 to hypural. L. tr. 15. Sc. $\frac{1}{2}/8/\frac{1}{2}$ on caudal peduncle.

Head, 3 in.; length to hypural, $11\frac{1}{4}$; length to end of middle caudal rays, $12\frac{1}{2}$; depth $3\frac{1}{8}$; pectoral, $2\frac{3}{4}$; depth of caudal peduncle, $1\frac{3}{8}$; interorbital, $1\frac{1}{2}$.

A narrow eyelid present. Narrow lanceolate interspace on chin. Maxillary entirely covered by preorbital.

Preorbital covered by skin, with spaced serrations. No teeth in jaws or on palate. Symphysis of lower jaw elevated. Thickness of upper lip equal to pupil of eye. Gill-rakers very numerous and close-set, but not nearly as long as gill-fringes. About 21 predorsal scales. Cycloid scales on head. Small scales extend along dorsal, anal and caudal rays.

Last dorsal and anal rays divided. Axillary scales well developed. Tip of pectoral reaching vertical of dorsal origin.

Second dorsal slightly in advance of anal, subequal in height to first dorsal. Caudal peduncle not as long as head.

Soft dorsal, anal and caudal margins excavate.

Colours in Life.—Dorsal scales olive grey, each one darker edged, with an inframarginal lighter area. Lateral scales greyish-silver, and ventral scales silvery white; anal scales shot with blue. Dorsal fins smoky grey, a narrow lighter margin to soft dorsal. Caudal grey, shot with an electric blue and greenish sheen near bases of rays. Anal greyish, the spinous and marginal portions white. Ventrals white. Pectoral light smoky grey, darkest mesially and on border of first ray, with white edge and base. A blue-black axillary blotch. Upper portion of upper lip stippled smoky; rest of mouth, jaws, and membranes white. Top of snout darker than rest of head. The darker dorsal shade changes to white on the opercles on a level with the upper part of the eye and the pectoral blotch. Pupil black, surrounded by a white ring; rest of eye smoky brownish.

Described from one (IA.4483) of several specimens seen swimming in a thick scum of algae inshore at Low Isles on 22nd August, 1928, and speared by one of the aboriginals. Owing to its rather large size only the head and some scales were preserved, but a sketch and the above description were made in the field after its capture.

Other specimens in the Australian Museum from Cape York, and Murray Island, Queensland.

The Low Isles specimen agrees with description of *Mugil splendens*, De Vis, but I have no specimens for comparison, and a sketch of the type shows a fish with Sc. 41 and a thicker upper lip. Jouan (Mém. Soc. Nat. Sci. Cherbourg, XXI, 1877, p. 333) regards *M. delicatus*, Alleyne and Macleay, as a synonym of *Mugil tegobuan*, Montrouzier (*i. e.* Thiollière, Ann. Sci. Phys. Nat. Agric. Lyon, VIII, p. 462, 1856; Essai Faun. Île Woodlark [Montrouzier], 1857, p. 184), but the latter is described as having teeth. Fowler (Mem. Bishop Mus. X, 1928, p. 124) unites *M. tegobuan* with *M. vaigiensis*, Quoy and Gaimard, and quotes Jouan in the synonymy.

Family EPINEPHELIDAE.

Genus *Epinephelus*, Bloch, 1793.

Epinephelus hoevenii (Bleeker).

(Plate II.)

? *Holocentrus caeruleopunctatus*, Bloch, Naturgesch. Ausl. Fische IV, 1790, p. 94, pl. ccxlii, fig. 2. Locality unknown.

Serranus hoevenii, Bleeker, Verh. Batavia Genoot. XXII, 1849, Perc., pp. 19 and 36. Batavia.

Serranus kunhardtii, Bleeker, Natuurk. Tijdschr. Ned. Ind. II, 1851, p. 169. Padang, Sumatra.

Epinephelus hoevenii, Bleeker, Atlas Ichth. VII, 1875, p. 63, pl. cclxxxii, fig. 1, pl. cclxxxvi, fig. 4, and pl. ccxc, fig. 4 (plates published 1870). East Indies.

Epinephelus caeruleopunctatus, Boulenger, Cat. Fish. Brit. Mus. Ed. 2, I, 1895, pp. 171 and 246; McCulloch, Proc. Linn. Soc. N.S.W. XLVI, 1921, p. 468. Queensland, etc.

A specimen from Low Isles (IA.4426) figured here, has D. xi/16; A. iii/8; V. i/5; P. 17; C. 15. It was caught with a smaller one (IA.4427) under stones in September, 1928.

Another specimen (IA.4502), larger than the one figured but also from Low Isles, has the following characteristics: D. xi/16; A. iii/8.

Eye equal to snout, almost 5 in head, which is nearly 3 in total length. Depth of body less than length of head.

Maxillary with some rudimentary scales.

A single anterior canine on each side of the symphysis of each jaw. Teeth in broad bands on jaws, becoming caniniform behind symphyses and on sides of mandibles posteriorly. A few teeth on vomer and palatines.

Interorbital less than diameter of eye, over 8 in head.

Upper limb of preoperculum serrated. Middle opercular spine much nearer lower than upper.

Scales mostly ciliated, in less than eighty transverse series on body, the rows slanting upwards and backwards. About twenty scales between origin of dorsal and lateral line.

Third to last dorsal spines subequal but not as long as anterior dorsal rays. Margin of all soft fins rounded.

General colour (in spirit) brown, covered with whitish spots of various sizes, but all less than eye and becoming faint on head. A dark brown "moustache" and a small dark blotch over caudal peduncle. Pectorals, ventrals, and anal duskier than dorsals and caudal.

Epinephelus corallicola (Cuvier and Valenciennes).*

Serranus corallicola, Cuvier and Valenciennes, Hist. Nat. Poiss. II, October, 1828, p. 336. *Ex.* Kuhl and van Hasselt MS. No locality (= Java); Macleay, Proc. Linn. Soc. N.S.W. II, 1878, p. 346 (Port Darwin); Fowler, Mem. Bishop Mus. X, 1928, p. 181.

Epinephelus corallicola, Boulenger, Cat. Fish. Brit. Mus. Ed. 2, I, 1895, p. 236; McCulloch, Mem. Aust. Mus. V, 1929, p. 147.

Serranus rubriniger and *S. subniger*, Saville-Kent, Gt. Barrier Reef, 1893, p. 369. *Nomina nuda.* Queensland.

A specimen (IA.4456) from Low Isles has the following characters: D. xi/16; A. iii/8(9).

Interorbital width less than diameter of eye.

Preoperculum serrated, but without strong spines at angle.

Middle opercular spine nearer lower than upper. Opercular flap excavate above. Broad bands of teeth in jaws, caniniform anteriorly. Maxillary naked.

Eye between 4 and 5 in head.

Scales ciliated. 53–57 tubes in l. lat. to hypural. Sc. *c.* 65 to 70 from head to hypural. L. tr. 16/1/40–45.

Fourth dorsal spine longest, the posterior spines gradually decreasing in length. Caudal rounded.

Dark brown, with large, widely spaced, black spots on head, body, and the dusky fins. Caudal with narrow white margin.

Total length 152 mm. Registered number IA.4456.

New record for Queensland. Specimens from New Guinea and Port Darwin, identified by Sir William Macleay, compared in the Australian Museum. Two *nomina nuda* of Saville-Kent, *Serranus rubriniger* and *S. subniger*, may best be disposed of by being relegated to the synonymy of this species.

Epinephelus merra, Bloch.

Four specimens (IA.4457, 4486–8) of this common coral fish from Low Isles. Large specimens were seen hiding in empty clam-shells (*Hippopus*) near the mangroves; they looked rather like the mantles of the clams, which barely filled the shells.

Genus *Plectropomus*, Schinz, 1822.

Plectropomus maculatus (Bloch).

A fine specimen (IA.4479) caught by Mr. Carl Vidgen off Low Isles.

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* *Serranus australis*, Castelnau (Res. Fish. Aust. 1875, p. 7; C. York) is described with D. xi/13 and different coloration. The Low Island specimen has fewer spots and narrower pre-orbital than *Serranus howlandi*, Günther (J. Mus. Godeffroy, III [Fische Südsee], 1873, p. 8, pl. ix, fig. B; Howland Is.).

Family APOGONIDAE.

Genus *Lovamia.* Whitley, 1930.

Lovamia cookii (Macleay).

Apogon fasciatus, Alleyne and Macleay, Proc. Linn. Soc. N.S.W. I, 1877, p. 267 (Queensland). Not *Mullus fasciatus*, White, 1790.

Apogon cookii, Macleay, Proc. Linn. Soc. N.S.W. V, February, 1881, p. 344 (Endeavour R. (type) an Darnley I., Queensland). Types in Macleay Museum, University of Sydney; *op. cit.* VII, 1882, p. 236 (Port Moresby, New Guinea); Fowler, Mem. Bishop Mus. X, 1928, p. 157.

Amia fasciata fasciata McCulloch, Biol. Res. "Endeavour," III, 3, 1915, p. 116 (North Queensland specimens).

Apogon endekataenia, Ogilby, Proc. Roy. Soc. Qd. XXI, 1908, p. 23 (Green I. and Dunk I., Queensland). Not *A. endekataenia* Bleeker. Natuurk. Tijdschr. Ned. Ind. III, 1852, p. 349, which has narrower stripes.

A Batt Reef specimen (IA.4065) agrees with other Great Barrier Reef examples in the Australian Museum in having D. vii/i, 9; A. ii/9. Twenty-eight tube-bearing scales on l. lat. Pectoral base without dark mark. Bands of body not continued on to tail, but converging slightly above and below large black spot at root of caudal. McCulloch regarded the North Queensland species as conspecific with *Mullus fasciatus*, White, but Sydney specimens have a deeper body, smaller eye, median band continued on caudal fin and no blackish blotch at base of tail. *Amia robusta*, Radcliffe (Proc. U.S. Nat. Mus. XLI, 1911, p. 254, pl. xxiv, fig. 2), is apparently a Philippine subspecies of *Lovamia cookii.* The Batt Reef specimen agrees with Hombron and Jacquinot's figure of *Apogon aroubiensis* (Voy. Pôle Sud., Zool. III, Poiss. 1853, p. 31, pl. i, fig. 1) in having a short snout and large eye, also in general form, but their illustration shows neither the anterior intercalated dorso-lateral bands, nor the spot at the root of the caudal which is so characteristic of *Lovamia cookii.*

It may be of interest to record here that the type-locality of *Apogon aroubiensis*, originally called Aroub, Malaysia, is Darnley Island, Torres Strait, which is still called Aroub or Erub by North Queensland aboriginals.

Lovamia cookii was common at Low Isles and Batt Reef and many young specimens (IA.4070, 4432, 4448 and 4504) were collected. These were found poised in swarms in still water sheltered by large blocks of coral such as *Porites*, or swimming between the long spines of sea-urchins (*Centrechinus setosus*), and could be caught in numbers with one sweep of a net. A series of nineteen specimens, 11–19 mm. long, caught in this way at Low Isles shows that the three main longitudinal bands, blotch at root of caudal and plain fins are juvenile as well as adult characters. The largest specimens have scales and incipient serrations on the preoperculum.

Weber and Beaufort (Fish. Indo-Austr. Archip. V, 1929, p. 306) regard *Apogon cookii* as a synonym of *A. endekataenia*, Bleeker, but although Bleeker's original description of the type from Banka agrees fairly well with the Queensland species, his figure (Atlas Ichth. VII, 1872, p. 85, plate cccx, fig. 2) shows a fish with much narrower bands on the body.

Genus *Foa*, Jordan and Evermann, 1905.

Foa vaiulae, Jordan and Seale.

Three specimens (IA.4461) from Batt Reef, caught in trailing brown weed, 13th September, 1928, and one (I.14507) from Walker's Bay, near Cooktown, are in the Australian Museum. The latter specimen is 45 mm. in length and was collected by A. R. McCulloch. Another small one (IA.4473) from Low Isles is darkly mottled, with traces of a transverse band on body and an opercular spot.

This species has not hitherto been recorded from Australia.

The East Indian *Foa fistulosa*, Weber (Notes Leyden, Mus. XXXI, 1909, p 162, and Fische Siboga Exped. 1913, p. 237, and fig.) should receive a new generic name, as that species has a subcutaneous tube on the tail which is lacking in species of *Foa*.

Genus *Aspiscis*, Whitley, 1930.

Aspiscis savayensis (Günther).

One (IA.4503) from Low Isles; amongst coral, reef flat, 1st October, 1928.

Family SILLAGINIDAE.

Genus *Sillago*, Cuvier, 1816.

Sillago gracilis, Alleyne and Macleay.

Sillago gracilis, Alleyne and Macleay, Proc. Linn. Soc. N.S.W. I, Feb. 1877, p. 279, pl. vi, fig. 2. Hall Sound, New Guinea or Darnley Island, Torres Strait, Queensland.

D. xi/i, 17; A. i/16. L. lat. 65 to hypural.

L. tr. 6/1/13.

Head (70 mm.) 3·3, depth (45) 5·1 in standard length (230). Interorbital (16) 4·3, eye (13) 5·3 in head.

Depth of caudal peduncle (21) less than postorbital portion of head (26). Preorbital (26) 2·7, pectoral (38) 1·9 in head.

Villiform teeth on jaws and roof of mouth.

Opercles entire.

Dorsals separate. First ventral rays with filiform tips.

The above are the characters of a specimen (IA.4481) caught on a small hook with mullet and pipi bait at Low Isles over sandy bottom inshore on 23rd August, 1928. A young one (IA.4466), with spotted body, was also obtained. The life colours of the larger specimen were as follows:

Light olive dorsally, darkest before the eyes. each scale with a darker margin. Ventral surface and most of sides white. First dorsal hyaline with large irregular smoky blotches. Second dorsal faint yellow with rows of smoky marks. Caudal light yellow, edged with smoky. Ventrals and anal white with a tinge of yellow. Pectorals hyaline with a blackish blotch on base. Pupil black, rest of eye pearly with dark grey superiorly. A small grey mark near the root of each ventral.

Family LUTJANIDAE.

Genus *Lutjanus*, Bloch, 1790.

Lutjanus fulviflamma unimaculatus, Quoy and Gaimard.

One (IA.4478) from Low Isles agrees perfectly with Quoy and Gaimard's description. Very common over open waters with sandy bottom in vicinity of mangroves.

Family LEIOGNATHIDAE.

Genus *Equula*, Cuvier, 1816.

Equula, Cuvier, Mem. Mus. Hist. Nat. Paris, I, "1815" = March, 1816, pp. 463 and 466. Genotype, *Scomber equula*, Forskal [= *Equula equula* (Bonnaterre)].

Head about one-third of standard length. Preoperculum serrated. Mouth protractile obliquely downwards. Second dorsal spine not produced. Eight dorsal spines. Depth about half the length of the fish. A band of curved, bristle-like teeth in each jaw. Breast and thorax naked. Lateral line ceasing just before root of caudal. Supra-orbital finely denticulated. No conspicuous colour markings.

These characteristics define the genus *Equula*, Cuvier, as distinct from *Leiognathus*, Lacepède. I have in manuscript a revision of the family Leiognathidae based on the collections in the Queensland and Australian Museums, and intend to give details in that paper of the limits of the genera and subgenera, concerning which some complex points in taxonomy have arisen. Mr. H. A. Longman has kindly lent me the types of the species described by De Vis and by Ogilby, which I intend to redescribe and illustrate in due course.

Equula obscura (Seale).

(Plate III, fig. 1.)

Leiognathus obscura, Seale, Occ. Pap. Bishop Mus. I, 3, 1901, p. 74. Guam, Marianas.

A large specimen (IA.4498), netted offshore at Low Isles, 24th September, 1928, has the following characters :

D. viii/16 ; A. iii/14. Curved bristle-like teeth in jaws. Lower preopercular margin distinctly serrated, as long as mandible. Supraorbital weakly denticulated. Caudal fin strongly forked. Depth (95 mm.) 1·6 in standard length (155) or a little over 2 in total length ($7\frac{9}{16}$ in.). Longest dorsal spine (33) 1·3, and longest anal spine (26) 1·7 in head (46).

This is probably the species regarded as *Leiognathus equula* by Australian writers. The figure of *Equula edentula* in Day's Fishes of India is very like the Low Isles specimen, which only seems to differ in colour and minor features. However, *Equula edentula*, Day, is not the same as *Scomber edentula*, Bloch, but is apparently *Equula coma*, Cuvier; this point will be more fully discussed in my forthcoming paper on the family Leiognathidae. Fowler (Mem. Bishop Mus. X, 1928, p. 153) unites *Leiognathus obscura*, Seale, with the Red Sea species described by Forskål which I regard as *Equula equula* (Bonnaterre), but the Pacific form appears to be at least subspecifically distinct.

Family GERRIDAE.

Genus *Gerres*, Quoy and Gaimard. 1824.

Gerres splendens, De Vis.

Gerres splendens, De Vis, Proc. Linn. Soc. N.S.W. IX, 19th August, 1884, p. 400. Cardwell, Queensland. Holotype in Queensland Museum; Whitley, Mem. Qd. Mus. X, 1930, p. 15, fig. 1 (holotype redescribed and figured).

A series of sixteen specimens from Low Isles mangrove swamps (IA.4331–4334) and two collected by Dr. Paradice from the same locality (IA.1697) have been compared with the type in the Queensland Museum. Young ones have the depth a little more than 3 in length to end of middle caudal rays, but in adults it is 3 or even a trifle less. Dorsal generally ix/10; only one has D. ix/11 and another D. ix/9. Second dorsal spine a little over 2 in depth of body. Suborbital and opercles smooth. L. lat. usually 41; rarely 40, sometimes 42 and occasionally 43–44.

Eye longer than snout and than anal spines. Pectoral not quite reaching anal origin. Upper caudal lobe subequal to head. Tip of first dorsal black; some dark spots on dorsal rays. Young bright silvery in general colour; adults with no spots on body, but sometimes with indistinct bars of darker scales.

This is perhaps one of the species regarded by Australian authors as *Labrus oyena*, Forskal.

Three post-larvae of this species (IA.4471, 4476) were tow-netted at night on 8th September, 1928. One very small specimen had a parasite like *Gnathia* near the tail. The majority of the larger specimens was obtained by making the water muddy by stirring up the bottom with the feet when wading; the fish were thus stupified and could be easily netted.

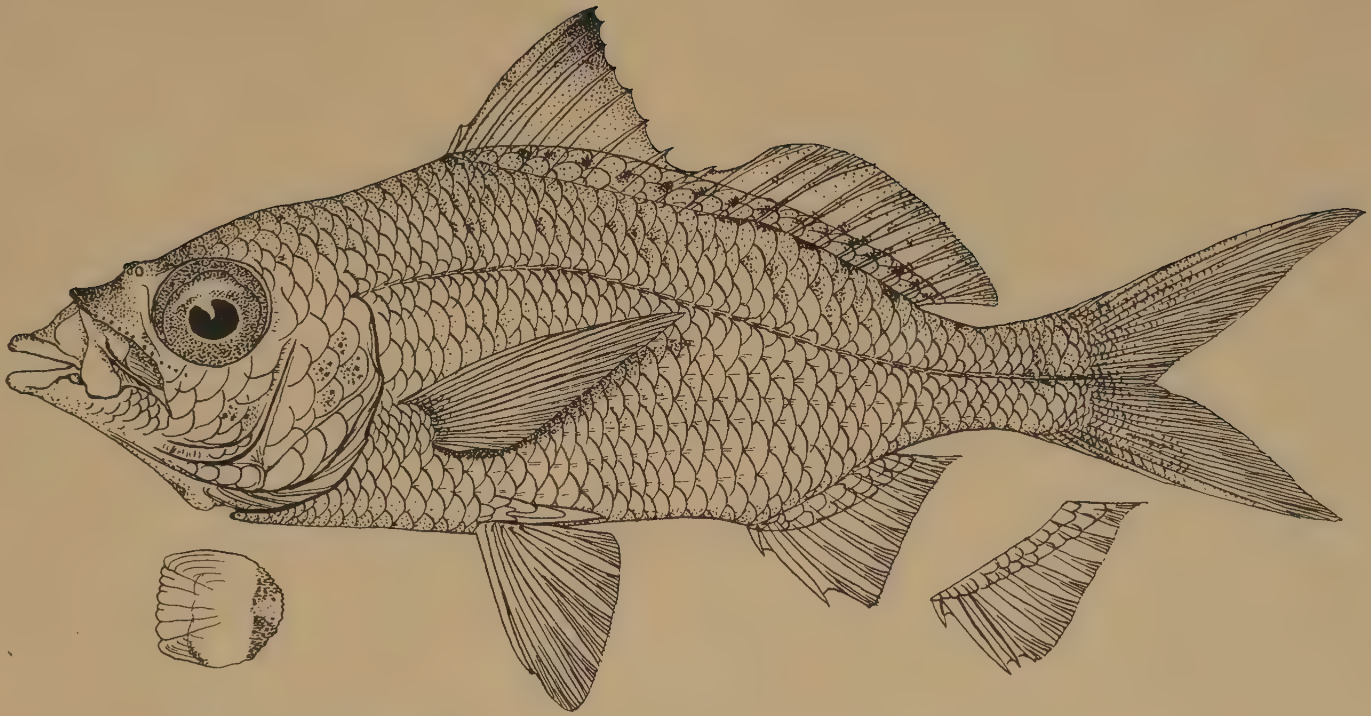
One specimen (IA.4614) was caught by seine net at North-West Islet, Capricorn Group, in May, 1930, by Mr. Melbourne Ward, so that this species evidently extends its range all along the Queensland coast.

Family CHAETODONTIDAE.

Genus *Chaetodon*, Linnaeus, 1758.

Chaetodon lunula (Lacepède).

A juvenile specimen in the "*Tholichthys*" stage (IA.4078) was caught beneath a boulder on the reef at Low Isles. It agrees with Günther's figure (Fische der Sudsee,



TEXT-FIG. 3.—*Gerres splendens*, De Vis. A specimen from Low Isles. Regd. no. IA.4333. Also a lateral scale of the same specimen and the normal form of anal fin drawn from a larger specimen from the same locality. Drawings by Gilbert P. Whitley.

pl. xxxiii, fig. D), but, as is sometimes the case in young specimens of this species, it lacks the dorsal ocellus.

Colours in the Fresh State.—General body colour pale yellow. Face whitish. The broad black ocular bands form a V-shaped mark on the breast before the ventrals; above the eye each band becomes browner with a lighter median area, and there is a blackish superciliary mark. Some black punctulations on the operculum and shoulder and above anal fin. An irregularly saddle-shaped blackish area below the hinder part of the dorsal and a narrow band around the caudal peduncle. First dorsal, ventrals and anterior portion of anal yellow. Pectorals, soft dorsal, caudal and posterior portion of anal hyaline.

Chaetodon vagabundus, Linnaeus.

One specimen from Low Isles, collected by Mr. F. W. Moorhouse, in the Queensland Museum (I.4589).

Genus *Rabdophorus*, Swainson, 1839.

Rabdophorus bennetti (Cuvier and Valenciennes).

Chaetodon bennetti, Cuvier and Valenciennes, Hist. Nat. Poiss. VII, 1831, p. 84; Sumatra; Fowler and Bean, Bull. U.S. Nat. Mus. 100, VIII, 1929, p. 73 (references and synonymy).

One young specimen (IA.4455) of this well-marked species from Low Isles.

New record for Australia.

Genus *Megaprotodon*, Guichenot, 1848.

Megaprotodon plebeius (Cuvier and Valenciennes).

Chaetodon plebeius, Gmelin, Syst. Nat. (Linnaeus), ed. 13, I, 3, 1789, p. 1269, footnote; *ex* Broussonet MS.; *nom. nud.*

Chaetodon plebeius, Cuvier and Valenciennes, Hist. Nat. Poiss. VII, April, 1831, p. 68; *ex* Broussonet MS. Mer du Sud; Fowler and Bean, Bull. U.S. Nat. Mus., 100, VIII, 1929, p. 78.

A juvenile specimen (IA.4069) 15 mm. in total length from Batt Reef.

Genus HOLACANTHUS, Lacepède, 1802.

Holacanthus sexstriatus, Cuvier and Valenciennes.

A large specimen from Low Isles in the Queensland Museum (I.4586). Another recorded from the same place by Tandy (Nat. Hist. Mag., London, July, 1929, II, p. 87, fig. 5).

Subgenus *Acanthochaetodon*, Bleeker, 1876.

Holacanthus (*Acanthochaetodon*) *semicirculatus*, Cuvier and Valenciennes.

One in the Queensland Museum (I.4639) from Low Isles.

Family SCOMBEROMORIDAE.

Genus *Scomberomorus*, Lacepède, 1802.

Scomberomorus commerson (Lacepède).

Some fisherman caught twenty-six Kingfish of this species near Snapper Island on 5th September, 1928. No specimens were preserved, but the following notes were made at the time.

"These fish were about nine or ten pounds in weight when cleaned and were developing the reproductive organs. The fishermen say they begin to get them here about June or July when they come up from the south. In about another month they will be larger and mature and will spawn about November. They are caught here until December, when they go south again.

"A lily or a piece of white or red rag is used as bait and trolled behind a launch. Kingfish bite very ferociously and are often caught in numbers. They do not stay long in one place, however, and may not be encountered the day after a good catch has been made."

Family AMPHACANTHIDAE.

Genus *Amphacanthus*, Bloch and Schneider, 1801.

Amphacanthus lineatus, Cuvier and Valenciennes.

Amphacanthus lineatus, Whitley, Rec. Aust. Mus. XVI, 1928, p. 231 (synonymy and localities).

A specimen from Low Isles (IA.4054).

Family AMPHIPRIONIDAE.

Genus *Amphiprion*, Bloch and Schneider, 1801.

Amphiprion bicinctus, Rüppell.

I am informed that Dr. T. A. Stephenson collected this species at Low Isles from a sea-anemone (*Stoichactis*).

Genus *Actinicola*, Fowler, 1904.

Actinicola percula (Lacepède).

(Plate I, fig. 2.)

Three Batt Reef specimens (IA.4062–4064) have D. x/16; A. ii/13; light snout, breast and pectorals; areas between dark-edged bands, pectorals, and most of caudal light in tone. They were collected by Messrs. McNeill and Livingstone, who noted them as commensals of an anemone.

Two specimens (I.4640–4641) in the Queensland Museum from Low Isles.

HABITS.—*Actinicola percula* was fairly common at Low Isles associated with the large sea-anemones (*Stoichactis*). Registered numbers of specimens preserved IA.4062–4, 4092. I made the following field observations on them :

The fish swims by turning body and tail to left, at the same time bringing left pectoral to side, then repeats action on right side. The ventral fins are kept extended all the time the fish is swimming as if feeling for bottom and are rarely moved ; this is a noteworthy feature in *Actinicola* and *Amphiprion*. The dorsal and anal are kept extended and lean from one side to another. A specimen kept in a bottle overnight was still active next morning, a feat of hardiness rare in a coral-reef fish, but probably this species has to withstand great changes of salinity, temperature, etc. I placed it amongst the tentacles of a different anemone on another part of the reef. After swimming about for some time as if to get its bearings, the fish snuggled into the tentacles, gently waving its fins, or else sheltered in the folds of the anemone, but I could not induce it to enter the anemone's mouth. The fish adopted its new host and was always to be found with it during my stay at Low Isles, and I added further specimens from time to time. *Actinicola percula* is sometimes accompanied by one or more prawns (*Periclimenes*) in association with an anemone, although the view is popularly held that the two organisms are not found together with their host. A photograph by Mr. W. Boardman of the fish and an anemone *in sitû* is reproduced here.

An early figure of this species was given by Valentyn (Amboina, III, 1726, fig. 525) and a Great Barrier Reef specimen was artistically described by Hedley (The Nautilus, XV, 1902, 9, p. 99.)

JUVENILE SPECIMENS.—At Batt Reef on 13th September, 1928, I collected in a small sea-anemone which differed from the large Low Isles species two small specimens of *Actinicola percula* (IA.4063–64). These were more active swimmers than the adult forms and there were no prawns with them. D. x/16 ; A. ii/13–14. Yellow on snout, breast, margin of pectorals and lower half of caudal peduncle ; areas between the two white bands crossing the body dark brown ; upper rays of caudal white, lower part of caudal mostly black ; pectorals mostly blackish. The blackish band passing through the eye does not join its fellow on the other side below the head. This is the juvenile colour-phase of the species, and has been figured in colours by Saville-Kent (*loc. cit.*) as *Amphiprion clarkii*. That species, however, was originally described as *Anthias clarkii* by Bennett (Fish Ceylon, April, 1830, p. 29, pl. xxix) and is a true *Amphiprion* with emarginate tail, deep body and scaly nape, and has not been found in Australian waters.

Family POMACENTRIDAE.

Subfamily *Pomacentrinae.*

Genus *Pseudopomacentrus*, Bleeker, 1877.

Pseudopomacentrus sufflavus (Whitley).

Mr. F. S. Russell obtained one specimen (IA.4429) at Low Isles. This species, which has the outer row of teeth conic terminally, not forming a compact cutting edge, is allied to *P. amboinensis* (Bleeker), but has origin of dorsal further back and depth 2 in standard length. In the shape of the tail and less deep body, *P. sufflavus* differs from *P. niomatus* (De Vis), but the three species are evidently quite closely related. Nevertheless, they are still too close to the typical *Pseudopomacentrus* (*littoralis*) to be considered even subgenerically distinct at present.

Pseudopomacentrus wardi macleayi (Whitley).

Pomacentrus obscurus, Alleyne and Macleay, Proc. Linn. Soc. N.S.W. I, March, 1877, p. 343, pl. xv, fig. 2. No locality (= Torres Strait, probably Darnley Island). Types in Macleay Museum, University of Sydney; lectotype described below. Name preoccupied by *Pomacentrus obscurus*, Thiollière, Ann. Agric. Soc. Lyon, VIII, 1856, p. 400; Essai Faune Île Woodlark (Montrouzier), 1857, p. 200; McCulloch and Whitley, Mem. Qd. Mus. VIII, 1925, p. 166.

Pomacentrus wardi, Whitley, Rec. Aust. Mus. XV, 6th April, 1927, p. 301, fig. 1; Heron I., Queensland. Holotype in Australian Museum: Whitley, Rec. Aust. Mus. XVI, 1927, p. 17 (Michaelmas Cay—variation).

Pomacentrus macleayi, Whitley, Rec. Aust. Mus., XVI, 28th March, 1928, p. 221; Torres Strait. New name for *P. obscurus*, Alleyne and Macleay, preoccupied.

Pseudopomacentrus macleayi, Whitley, Mem. Qd. Mus. IX, 1929, p. 236.

Pseudopomacentrus wardi, Whitley, Mem. Qd. Mus. IX, 1929, p. 237.

D. xiii/14; A. ii/13; P. i/17; V. i/5; C. 13.

17 tubes on l. lat. Sc. 24; L. tr. 2/1/9.

Head (17 mm.) 3·6 in length to hypural joint (62); depth (24) 2·5 in same. Snout (4) 1·2 in interorbital width (5), which is a trifle less than eye (5·5). Depth of caudal peduncle (8) 8·5 in total length (69).

Head scaly except on preorbital, jaws and throat. Rows of pores along the preorbital, whose margin is serrated and notched. Preoperculum strongly serrated. Two small opercular spines. Eye large. Interorbital convex. Mouth small, maxillary not reaching vertical of anterior margin of eye. A single series of compressed incisors in each jaw.

Form ovate, compressed. Body covered with ctenoid scales which extend on to all the fins except ventrals. About nineteen predorsal scales. Lateral line gently curved. Caudal peduncle not tapering abruptly.

Dorsal originating in advance of pectorals, its spines increasing in height backwards and interspaced with pencilled membranes; the soft dorsal terminates behind the anal. Caudal forked, the upper lobe longer.

Colour (after long preservation in alcohol) uniform straw-brownish with the ventrals and anal darker. A small black spot, margined anteriorly with white, on the caudal peduncle behind the last dorsal ray.

Described from the lectotype of *Pomacentrus obscurus*, Alleyne and Macleay, or the holotype of *P. macleayi*, Whitley. The specimen is 2¾ in. long and was figured by Alleyne and Macleay. It is one of four Torres Strait specimens which have been kindly lent me by the Curator of the Macleay Museum, University of Sydney, to whom I wish to record my thanks.

P. obscurus = *macleayi* is closely allied to *P. wardi*, and, after having compared many specimens of both forms, I have arrived at the conclusion that two subspecies are represented which may be distinguished as follows:

A. Depth 2 or less in length from snout to hypural joint. Usually 15 dorsal rays. Coloration brownish, no spot on caudal peduncle *P. wardi wardi.*

A.A. Depth more than 2 in length to hypural. 13 to 14 dorsal rays. Coloration olivaceous; most specimens with a black spot, margined with white anteriorly, on caudal peduncle behind last dorsal ray *P. wardi macleayi.*

Thus, *Pseudopomacentrus wardi macleayi* is evidently a northern subspecies ranging from Torres Strait down to the Whitsunday Passage, whilst *P. wardi wardi* extends from the latter place to the southernmost islets of the Great Barrier Reef.

These forms are so close to *Pomacentrus trilineatus*, Bleeker (Atlas Ichth., IX, 1877, pl. ccccvi, figs. 1–6; *non* Cuvier and Valenciennes, *s. str.*), and *P. niomatus*, De Vis (Proc. Linn. Soc. N.S.W. VIII, 1884, p. 451; Whitley, Mem. Qd. Mus. IX, 1929, p. 220, fig. 2), that they would be regarded as conspecific by the casual worker, but, after examining large series of Australian specimens, I am convinced that no good purpose can be served by uniting them, as many more races, varieties and subspecies of these fishes appear to exist within geographical limits than are at present recognized.

Pseudopomacentrus wardi macleayi was common at Low Isles, where the aboriginals called it "young bluefish." It sheltered beneath boulders at low water and could be easily netted. The general coloration was olive greenish, often irregularly blotchy. Others are described in my notes as "dark olive greenish, each scale grey-edged." A small specimen had a tiny violet spot at the termination of the dorsal fin. There is a tendency towards a light inframarginal band along the spinous dorsal, whilst the anal and ventrals are darker.

Thirty-one specimens (IA.4080–4086) from Low Isles in the Australian Museum and three (I.4498–4500) in the Queensland Museum.

A specimen collected at Low Isles by Dr. Paradice (IA.1699) and another from Port Darwin (IA.3603) have a black ocellus on the median dorsal rays and three rows of scales on the cheeks. These specimens are 36 mm. in standard length.

Subfamily *Glyphisodontinae.*

Genus *Glyphisodon*, Lacepède, 1802.

Glyphisodon palmeri, Cockerell.

Two specimens from Low Isles (IA.4330 and 4484).

Range.—North Australia and Queensland.

Glyphisodon coelestinus, Cuvier and Valenciennes.

One specimen (IA.4097) from Low Isles, August, 1928.

Genus *Glyphidodontops*, Bleeker, 1877.

Glyphidodontops biocellatus (Quoy and Gaimard).

Glyphisodon biocellatus, Quoy and Gaimard, Voy. Uranie and Physicienne, Zool., 1825, p. 389; Guam.

Glyphisodon antjerius, Cuvier and Valenciennes, Hist. Nat. Poiss. V, July, 1830, p. 481; *ex* Kuhl and van Hasselt MS.; Java.

Abudefduf biocellatus, Fowler and Bean, Bull. U.S. Nat. Mus. 100, VII, 1928, pp. 124 and 166 (references and synonymy).

One small specimen (IA. 4433) is referred to this species: it agrees with the form called *Glyphisodon antjerius*. New record for Australia, since the species identified as *G. antjerius* from New South Wales is the young of *Parma*. I regard *Chaetodon brownriggii*, Bennett, (Fish. Ceylon, June, 1828, p. 8, pl. viii; Ceylon), as distinct.

The following notes were made on 21st September, 1928, after the specimen had been kept alive in a finger-bowl overnight:

Life Colours.—Dark olivaceous on top of head and back; brilliant yellow on lower parts of head, sides, and caudal peduncle. Two brilliant blue bands on each side of snout ascending obliquely backwards; the lower one passes through the dark bluish eye. A large black ocellus on second dorsal, surrounded by brilliant blue. Anterior dorsal rays bluish, posterior rays orange-yellow. Ventrals and anal orange, some of the rays black-tipped. Pectorals and caudal hyaline.

This species was sometimes seen swimming slowly near banks of coral in the inner rampart and madrepore moat, but was difficult to catch as it could hide amongst the most inaccessible coral branches or take short cuts through the smallest gaps. Others fed on minute material on the coral debris banks flanking the edge of the mangrove swamp associated with other Pomacentridae.

Family Chromidae.

Genus *Chromis*, Cuvier, 1814.

Chromis nitidus (Whitley).

Tetradrachmum nitidum, Whitley, Rec. Aust. Mus. XVI, 1928, p. 219, pl. xvii, fig. 3; Hayman Island, Queensland.

One young one (IA. 4449) from Batt Reef, 13th September, 1928. Several young were swimming round blocks of *Porites* and, as this was the first time I had seen this species alive, I noted that the top of the head was brilliant yellow margined by a black band. Sides silvery and, by contrast, almost invisible in the water. Closer inspection revealed the dark streaks on the anal and caudal fins. This species was also common on an uncharted reef between Batt and Tongue Reefs, visited 27th September.

Genus *Tetradrachmum*, Cantor, 1849.

Tetradrachmum aruanum (Linnaeus).

Two (IA.4095–4096) from Low Isles.

Genus *Hoplochromis*, Fowler, 1918.

Hoplochromis caeruleus (Cuvier and Valenciennes).

Two (IA.4061) from Batt Reef.

Family Labridae.

Genus *Hemigymnus*, Günther, 1861.

Subgenus *Cheilolabrus*, Alleyne and Macleay, 1877.

Hemigymnus (*Cheilolabrus*) *melapterus* (Bloch).

One young specimen (IA.4428) agreeing with Bleeker's figure (Atlas Ichth., I. 1862, p. 412, pl. xlv, fig. 3) from coral block in the madrepore moat, Low Isles.

Cheilolabrus, Alleyne and Macleay, 1877, may be used subgenerically for the species lacking several whitish transverse bands. This name was amended to *Chi*(*lolabrus*) on p. 2 of the Index to the Zoological Record for 1877 (published 1879). *Thalliurus*, Swainson, 1839, was proposed for *C*(*heilinus*) *blochii*, Swainson [not Cuvier and Valenciennes, 1839 (= *Hemigymnus fasciatus*)], based on *Labrus chlorourus*, Bloch, 1791, which is not congeneric with *Hemigymnus*.

Family Julidae.

Genus *Octocynodon*, Fowler, 1904.

Octocynodon margaritaceus (Cuvier and Valenciennes).

One (IA.4453) from Low Isles. This species has been called *Halichoeres opercularis* by Australian authors.

Octocynodon miniatus (Cuvier and Valenciennes).

Three (IA.4454) from Low Isles.

Genus *Guntheria*, Bleeker, 1861.

Guntheria trimaculata (Griffith).

One (IA.4505) from Batt Reef; 13th September, 1928. D. ix/11; A. iii/11.

Family Coridae.

Genus *Hemicoris*, Bleeker, 1861.

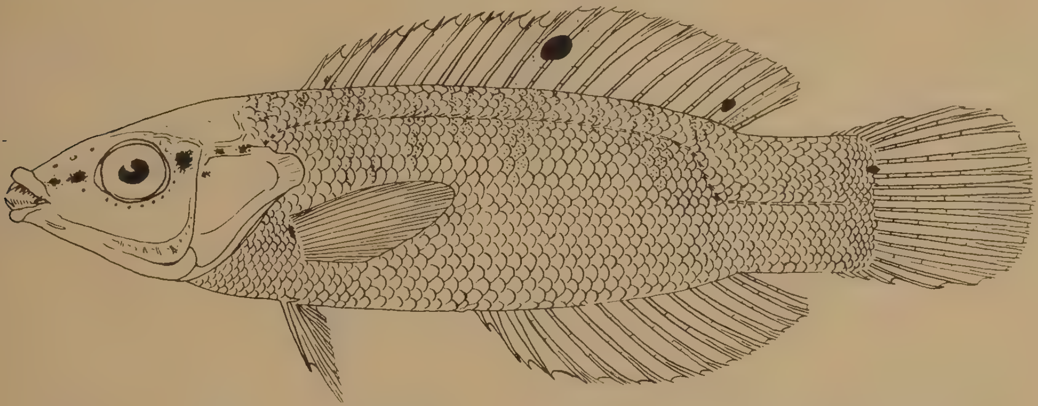
Hemicoris pallida (Macleay).

Coris pallida, Macleay, Proc. Linn. Soc. N.S.W. VI, July, 1881, p. 100; Endeavour River, Queensland. Holotype in Macleay Museum, University of Sydney.

Two small specimens (IA.4460) from a trailing brown seaweed on sandy bottom at Batt Reef, 13th September, 1928. A larger specimen is in the Australian Museum from Murray Island, Queensland.

CHARACTERS.—Cheeks naked. Preoperculum entire. Depth less than length of head and less than 5 in total length. Lateral line continuous, bent abruptly behind, with fifty-six scales, of which forty are on the straight anterior portion. L. tr. 6/20. D. ix/11; A. iii/11. No produced dorsal spines. Caudal rounded. Pectoral subequal to distance from posterior margin of eye to snout.

General colour, in spirits, yellowish brown, silvery on thorax and with five or six faint dusky transverse bars, with traces of white intermediate bars, on body. Eye surrounded by milky-blue, forming a post-orbital mark. No marks on cheek, but one specimen has a dusky pre-orbital blotch. A black spot between the first and second dorsal spines, a larger white-edged one on second dorsal ray, and a small spot between ninth and tenth dorsal rays. A black dot on upper half of caudal root. A dark brown bar on pectoral base.



TEXT-FIG. 4.—*Hemicoris pallida* (Macleay). A specimen from Batt Reef. Regd. no. IA.4460. Drawing by Gilbert P. Whitley.

This species is near *Halichoeres variegatus*, Rüppell (Neue Wirbelth. Abyssin. Fische, 1835, p. 14, pl. iv, fig. 2), from the Red Sea, but differs in coloration, and in having a narrower cheek and one dorsal ray less.

Family BODIANIDAE.

Genus *Choerodon*, Bleeker, 1845.

Choerodon, sp. juv.

D. 13/7; A. 3/10. L. lat. 29; L. tr. 2/1/7.

Cheeks narrow. Maxillary not reaching eye. A confluent series of pointed teeth in each jaw. Two enlarged teeth near symphysis of upper jaw and about four near that of lower. Preoperculum with about a dozen serrations on its vertical limb. Opercles scaly and with a long and broad rounded flap.

Depth (5 mm.) 2·9 in standard length (14·5).

Lateral line continuous, not bent abruptly. Scales large, entire, leaf-like, not forming sheaths for fins.

Ventrals not reaching anal.

General colour yellowish with a green tinge on the fins. A dusky tinge on anterior portions of dorsal and anal, middle portion of ventrals, and base of lowest caudal ray. Tips of ventrals white. A large silver blotch on cheeks and another before pectoral base.

One small specimen (IA.4475) standard length 14·5 mm.; total length ¾ in.; found under a stone on reef flat, 6th September, 1928. This is evidently the greenish post-larval form of some species of *Choerodon*, but I am unable to identify it specifically.

Family OPISTHOGNATHIDAE.

Genus *Tandya*, Whitley, 1930.

Tandya maculata (Alleyne and Macleay).

Opisthognathus maculatus, Alleyne and Macleay, Proc. Linn. Soc. N.S.W., I, February, 1877, p. 280, pl. ix, fig. 3; Palm Is., N.Qd. ("Chevert" Expedition).
Batrachus punctatulus, Ramsay, Proc. Linn. Soc. N.S.W. VIII, 19th June, 1883, p. 177; Torres Strait, N.Qd. Type (I.1254) in Australian Museum, Sydney. Name emended to *B. punctulatus* by authors.
Gnathypops maculatus, McCulloch, Rec. W. Aust. Mus., 1, 1914, p. 216.
Gnathypops maculata, Ogilby, Mem. Qd. Mus. VII, 30th June, 1920, p. 27, pl. iii (description and figure of Aru I. specimen).
Tandya maculata, Whitley, Mem. Qd. Mus. X, 1930, p. 19.

A large female from Low Isles (IA.4051) compared with the type of *Batrachus punctatulus* in the Australian Museum.

RANGE.—North Australia, Queensland, and Aru Islands.

Family PARAPERCIDAE.

Genus *Parapercis*, Bleeker, 1863.

Parapercis cylindrica (Bloch).

Five specimens (IA.4450–2) of this common Queensland fish from Low Isles. D. v/21; A. i/17; teeth on vomer and palatines.

Family CALLIONYMIDAE.

Genus *Callionymus*, Linnaeus, 1758.

Callionymus calliste, Jordan and Fowler.

Callionymus calliste, Jordan and Fowler, Proc. U.S. Nat. Mus. XXV, 1903, p. 954, fig. 8; Misaki, Japan.

Head and anterior part of body strongly depressed. A pair of granulated raised occipital areas behind eyes. Preopercular spine with three large hooks above and an antrorse barb below. Interorbital very narrow. Four dorsal spines, connected by membrane to their tips, the first longest, nearly equal to distance from posterior orbital border to tip of snout. Soft dorsal separate, with eight simple rays, the last one divided to its base, longer than last anal ray, and reaching to base of upper caudal ray. Anal originating below first dorsal ray, with seven rays, similar to those of dorsal. P. 18; V. i/5. Ventral membrane covering bases of lower pectoral rays.

General colour sandy brown on back, with irregular mottlings formed by closely grouped blackish punctulations or with creamy spots partly enclosed in dark crescentic borders. Ventral surface plain whitish or yellowish. A series of ill-defined fuscous cross-bars on body and a row of dark spots on sides below lateral line. Two upright dark stripes on cheek and another on each pectoral base. All fins speckled blackish except anal, which is plain. A row of larger spots on lower half of caudal and a cream spot at root of that fin. Some cream and black spots on ventrals and a larger black spot near tip of longest ray.

Described from a small specimen (IA.4463), 32 mm. in standard length or $1\frac{5}{8}$ in. in total length, from Batt Reef, Queensland. This is evidently a young female of *Callionymus calliste*, Jordan and Fowler, the only major differences between my specimen and the account of that species being eye longer than snout and about one-third length of head, last dorsal ray longer than last anal ray, and caudal more rounded. A similar specimen (IA.4630) from Low Isles.

New record for Australia.

Specimens identified as *Callionymus microps*, Günther, from Michaelmas Cay are quite different from *C. calliste*, being plumper and much darker in colour.

Callionymus japonicus scaber, McCulloch, from Lord Howe Island, *C. lunatus*, Temminck and Schlegel, and *C. valenciennesii*, Temminck and Schlegel, from Japan, were included by error in a key to the Australian species of *Callionymus* by McCulloch (Biol. Res. Endeavour, V, 1926, pp. 195–196). None of these species is yet certainly known from Australian waters.

Family SALARIIDAE.

Key to Australian Genera of the Subfamily Salariinae.

A. A row of cirrhi crossing the neck to the opercular lobes *Cirripectus*, Swainson, 1839.
A.A. No such row of cirrhi, but a single tentacle may be present on each side of the nuchal region.
  B. Each side of mandible with a row of small teeth; no canines *Ecsenius*, McCulloch, 1923.
  B.B. Each side of mandible either toothless or with a single canine.
    C. Dorsal fin not incised between spines and rays. Canines very small or absent . . . . . . *Salarias*, Cuvier, 1816.
    C.C. Dorsal fin incised between spines and rays. Canines usually present.
      D. Seventeen dorsal and nineteen anal rays . . *Negoscartes*, Whitley, 1930.

      D.D. Nineteen or more dorsal and anal rays.
        E. Upper lip crenulated . . . . . *Crenalticus*, Whitley, 1930.

        E.E. Upper lip entire . . . . . *Rupiscartes*, Swainson, 1839.
        (Syn. "*Alticus*" [Comm.], Lac., 1800).

Genus *Salarias*, Cuvier, 1816.

Salarias fasciatus lineolatus, Alleyne and Macleay.

Blennius fasciatus, Bloch, Naturgesch. ausl. Fische, II, 1786, p. 110, pl. clxii, fig. 1; East Indies and Japan.
Salarias lineolatus, Alleyne and Macleay, Proc. Linn. Soc. N.S.W. I, March, 1877, p. 336, pl. xiii, fig. 2; Darnley Island, Queensland.
Salarias fasciatus, McCulloch, Rec. Aust. Mus. XIV, 1923, p. 123, pl. xv, fig. 3; Two Isles, Qd.

In his original account and figure, Bloch gives D. 29 and A. 19. The Queensland form of this species has D. xii–xiii/18–19; A. ii/19–20. A comparison of McCulloch's figure with that of Bloch shows marked differences in pattern and the vent midway between forehead and tail in the Australian form, which may be known subspecifically by Alleyne and Macleay's name.

Four (IA.4438–4440) from Low Isles; western moat, 9th September, 1928, and on reef flat, 14th September.

Genus *Negoscartes*, Whitley, 1930.

Negoscartes irroratus (Alleyne and Macleay).

One (IA.4441) Low Isles; another specimen (IA.4013) collected in General Survey. This is the type-locality of this species.

Genus *Crenalticus*, Whitley, 1930.

Crenalticus meleagris (Cuvier and Valenciennes).

Ten (IA.4442–3) from Low Isles; one specimen (IA.4014) collected in General Survey at Three Isles.

Two (IA.4444) from Snapper Island.

The type probably came from north-western Australia or Timor, so that Queensland forms may prove to be subspecifically distinct; in this case a new name may be required.

Genus *Rupiscartes*, Swainson, 1839.

Rupiscartes lineatus (Cuvier and Valenciennes).

One (IA.4437) from amongst rocks, the boulder track, Low Isles, 4th September, 1928.

Subfamily *Petroscirtinae*.

Genus *Petroscirtes*, Rüppell, 1830–1.

Petroscirtes hypselopterus, Bleeker.

Petroscirtes hypselopterus, Bleeker, Natuurk. Tijdschr. Ned. Ind. VIII, 1855, pp. 393, 399 and 423; Amboina.

This species, obtained at Low Isles, has not hitherto been recorded from Australia.

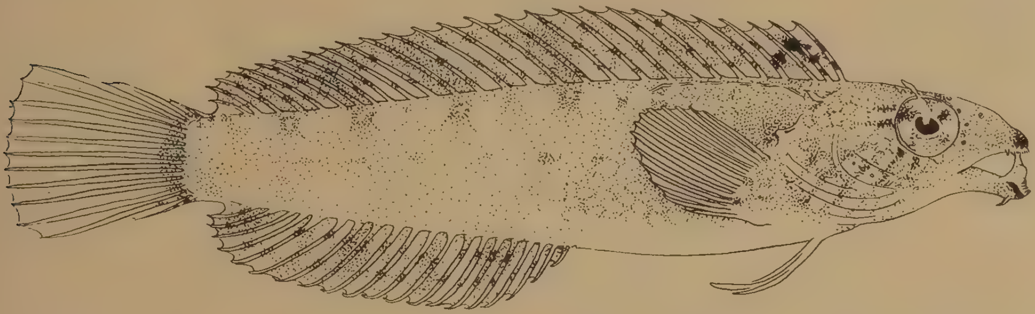
D. iii/23 ; A. i/5 ; V. 3 ; P. 15 ; C. 11. Jaws each with a single series of immovable incisors and large lateral canines.

Branched tentacles over eye, other smaller tentacles on cheeks, around chin. Maxillary extending to below anterior third of eye. Interorbital concave, half diameter of eye, which is equal to snout. Gill-opening small, above pectoral base.

Body naked ; lateral line almost obsolete, near back. Depth 4 in standard length. Head 3·7 in same.

Anterior three dorsal spines elevated and separated from the rays by a notch. Caudal rounded.

Ground-colour yellowish, densely marbled with black and brown to form a complicated marmorated pattern. Head and breast white-spotted. Two from Low Isles (IA.4445–6).



TEXT-FIG. 5.—*Petroscirtes viperidens* (De Vis). A specimen from Batt Reef. Regd. no. IA.4896. Drawing by Gilbert P. Whitley.

Petroscirtes viperidens (De Vis).

Salarias viperidens, De Vis, Proc. Linn. Soc. N.S.W. IX, 29th November, 1884, p. 697. Somerset, Cape York, Queensland. Types in Queensland Museum ; co-types in Australian Museum ; De Vis, Proc. Roy. Soc. Qd. II, 1886, p. 59.

Petroscirtes viperidens, McCulloch and McNeill. Rec. Aust. Mus. XII, 4th February, 1918, p. 23.

The accompanying figure is from a Batt Reef specimen (IA.4896), which has the following characters : D. 28 ; A. 20 ; P. 13 ; V. 3 ; C. 11.

Depth (10 mm.) 4·8, head (14) 3·4 in standard length (48). Eye (3·5) a little less than snout (3·7) and 4 in head.

A small tentacle over each eye and another on each side of the nape ; a small flap on each side of the chin.

General coloration, various shades of brown, disposed in markings as shown in the the figure. Belly plain. A dusky band across the base of the otherwise hyaline caudal fin.

Two others (IA.4447) from Batt Reef. Identified by comparison with co-types in the Australian Museum. Distinguished from *P. hypselopterus* by the much smaller tentacles, low dorsal spines, longer body, and lighter coloration, with plain belly.

Family Batrachoididae.

Genus *Coryzichthys*, Ogilby, 1908.

Coryzichthys diemensis (Le Sueur).

One specimen (IA.4482) from Low Isles. Eastern Australian forms with the throat mottled may represent a distinct subspecies, *C. diemensis queenslandiae* (De Vis), with *C. guttulatus*, Ogilby, as a synonym.

Family Eleotridae.

Genus *Calleleotris*, Gill, 1863.

Subgenus *Gergobius*, Whitley, 1930.

Calleleotris (*Gergobius*) *taeniura* (Macleay).

One specimen (IA.4345) from Low Isles, the type-locality.

Calleleotris (*Gergobius*) *muralis* (Cuvier and Valenciennes).

Eleotris muralis, Cuvier and Valenciennes, Hist. Nat. Poiss. XII, March, 1837, p. 253, pl. ccclvii; Tukopia, Santa Cruz Archipelago (Quoy and Gaimard).
Eleotris lineata, Castelnau, Vict. Offic. Rec. Philad. Exhib. 1875, p. 24; Cape York, Queensland.
Eleotris nigrifilis, Ogilby, Proc. Linn. Soc. N.S.W. XXI, 31st May, 1897, p. 754. New name for *Eleotris lineata*, Castelnau, regarded as anticipated by *Dormitator lineata*, Gill, 1863; Cape York, Queensland.
Valenciennea aruensis, Ogilby, Proc. Ry. Soc. Qd. XXIII, 7th November, 1910, p. 21; Aru Is.
Valenciennea muralis, McCulloch and Ogilby, Rec. Aust. Mus. XII, 1919, p. 216, pl. xxxvii, fig. 4, and as *V. lineata* on p. 264.
Calleleotris muralis and *lineata*, McCulloch, Mem. Aust. Mus. V, 1929, p. 367.

One (IA.4346) from Low Isles. Under stones, 16th September, 1928.

Eleotris lineata, Castelnau, and *E. nigrifilis*, Ogilby, are obviously synonyms of this species.

Genus *Asterropterix*, Rüppell, 1830–1.

Asterropterix semipunctatus quisqualis, subsp. n.

The Queensland fish, the type of which has been described and figured by Ogilby (Mem. Qd. Mus. III, 1915, p. 125, pl. xxix, fig. 2), is hereby separated subspecifically from the typical *Asterropterix semipunctatus*, Rüppell, Atlas zu der Reise im N. Afrika (Senckenb. Nat. Ges.), 1830–31, p. 138, pl. xxxiv, fig. 4, from the Red Sea, on account of its fewer dorsal rays, and the lower spinous dorsal and ventral fins.

Six (IA.4347) from Low Isles, where the species is not so common as it is in other places on the Great Barrier Reef.

Genus *Eviota*, Jenkins, 1903.

Eviota viridis queenslandica, subsp. n.

Allogobius viridis, Waite, Rec. Aust. Mus. V, 11th March, 1904, p. 177, pl. xxiii, fig. 3; Lord Howe Is. Types in Aust. Mus., Sydney.

Eviota viridis, McCulloch, Rec. Aust. Mus. IX, May, 1913, p. 386 (Great Barrier Reef locs.); Waite, Trans. Roy. Soc. S. Aust. XL, 1916, p. 454; McCulloch and Ogilby, Rec. Aust. Mus. XII, 1919, p. 260; Whitley, Aust. Zool., IV, 1926, p. 234 (North-West Islet, Qd.). and Rec. Aust. Mus. XVI, 1927, p. 27 (Michaelmas Cay, Qd.); *op. cit.* XVI, 1928, p. 302 (Hoskyn I., Qd.); Fowler, Mem. Bishop. Mus. X, 1928, p. 395.

Compared with typical specimens of *Eviota viridis* from Lord Howe Island, the Queensland form of this species is easily distinguished by its darker general coloration, large spots on head and two dark spots, which may be diffuse, on pectoral base. For this reason I name the Great Barrier Reef subspecies *Eviota viridis queenslandica*, the holotype being a specimen (IA.4068) from Batt Reef. This species is common in coral, and will probably be found to be separable into different subspecies from separate geographical areas. Specimens in the Australian Museum from the New Hebrides resemble the Queensland form in facies, whilst the Samoan *Eviota zonura*, Jordan and Seale (Bull. U.S. Bur. Fish, XXV, 1905 [15th December, 1906], p. 396, fig. 75), is apparently another subspecies. The described species of *Eviota* are evidently closely allied, and have bristle-like branches on the ventral and lower pectoral rays and naked nuchal region. The latter character is the main one for distinguishing *Eviota* from *Trimma*, Jordan and Seale (*loc. cit.*, pp. 381 and 391).

At Low Isles a few specimens of the new subspecies were secured (IA.4093, 4338).

Family Gobiidae.

Genus *Gobius*, Linnaeus, 1758.

Istigobius, subgen. nov.

Genotype *Gobius* (*Istigobius*) *stephensoni*, sp. n.

Distinguished from the true Palaearctic genus *Gobius* (type *G. niger*, Linnaeus) by its strongly contrasted colour pattern, larger scales, and longer caudal peduncle.

Gobius (*Istigobius*) *stephensoni*, sp. n.

Gobius maculatus, Castelnau, Vict. Offic. Rec. Philad. Exhib. 1875, p. 20; Queensland. Name preoccupied by *G. maculatus*, Nardo, Isis, XX, 6th June, 1827, p. 475.

Gobius ornatus, McCulloch and Ogilby, Rec. Aust. Mus. XII, 1919, p. 227, pl. xxxiii, fig. 2. Murray Island specimen is type of *G. stephensoni*. Not *G. ornatus*, Rüppell, 1830–1; Whitley, Rec. Aust. Mus. XVI, 1927, p. 28 (Michaelmas Cay, etc.), and of Australian authors.

The Queensland form of *Gobius ornatus*, Rüppell, was named *Gobius maculatus* by Castelnau, but this name was preoccupied by *G. maculatus*, Nardo, and may now be replaced by *Gobius stephensoni*, named in honour of Dr. T. A. Stephenson of London University. This species is allied to the North-West Australian *Gobius interstinctus*, Richardson (Zool. Voy. " Erebus " and " Terror," Fish, 1844, p. 3, pl. v, figs. 3–6), but differs from Richardson's description and figure in having free upper pectoral rays, and ground-colour lighter in tone. The holotype of *Gobius stephensoni* is the specimen from Murray Island described and figured by McCulloch and Ogilby.

Fourteen (IA.4350) from Low Isles, where the species was common. Others seen at Snapper Island.

Genus *Bathygobius*, Bleeker, 1878.

Bathygobius fuscus darnleyensis (Alleyne and Macleay).

? *Gobius fuscus*, Rüppell, Atlas zu der Reise im N. Afrika (Senckenb. Nat. Ges.), Fische, 1830–31, p. 137; Red Sea.

Gobius darnleyensis, Alleyne and Macleay, Proc. Linn. Soc. N.S.W. I, March, 1877, p. 331, pl. xii, fig. 1; Darnley I., Queensland.

Gobius nigripinnis, Alleyne and Macleay, Proc. Linn. Soc. N.S.W. I, March, 1877, p. 332, pl. xii, fig. 2; Palm Island, Queensland. Preoccupied by *G. nigripinnis*, Cuvier and Valenciennes, Hist. Nat. Poiss. XIII, 1837, p. 101.

Gobius marginalis, De Vis, Proc. Linn. Soc. N.S.W. IX, 29th November, 1884, p. 686; Cape York, Queensland.

Mapo fuscus, McCulloch and Ogilby, Rec. Aust. Mus. XII, 1919, p. 231, pl. xxxiii, fig. 3; Darnley I., Torres Strait.

Four small specimens (IA.4430) and one larger one (IA.4431) from Low Isles.

Gobius nigripinnis, Alleyne and Macleay, is preoccupied, but *G. darnleyensis*, of the same authors, has page-priority, and is available for the Queensland form of *Bathygobius fuscus*.

Genus *Metagobius*, Whitley, 1930.

In this genus the ventral fins are only united by a small basal membrane and the scales are larger and the body shorter than in *Callogobius*, Bleeker.

Metagobius sclateri (Steindachner).

One from Low Isles (IA.4348) swimming with the ventral fins separated. The original description of this species is not available to me but, on zoogeographical grounds, it seems reasonable to suppose that the North Queensland form may not be identical with the typical Tahitian one; in which case a new name would have to be proposed for the Australian species.

Genus *Amblygobius*, Bleeker, 1874.

Amblygobius phalaena (Cuvier and Valenciennes).

A female in roe (IA.4349) from Low Isles.

Yongeichthys, gen. nov.

Genotype, *Gobius criniger*, Cuvier and Valenciennes.

Body robust, compressed, covered with large ctenoid scales, which become cycloid on the breast and the base of the pectoral. Head entirely naked, with lines of mucigerous pores crossing the cheeks and opercles, and large open pores above the nostrils, on the interorbital space, along the nuchal groove, and around the preopercular margin. Snout obtuse, the profile convex. Jaws subequal. Mouth a little oblique; no barbels. A band of villiform teeth in each jaw, and an outer series of enlarged ones; a subcaniniform tooth may be present on each side of the mandible. Tongue subtruncate, free anteriorly. Gill-openings lateral, the isthmus broad. Exposed edge of shoulder-girdle smooth. Pseudobranchiae present. Gill-rakers short, thick, about five on lower limb of first branchial arch. Dorsal with six spines and about ten rays. Anal similar to soft dorsal. Pectoral rounded, its upper rays not free. Ventrals large, united, with a broad basal membrane. Caudal rounded.

Equivalent to *Rhinogobius*, McCulloch and Ogilby, 1919, *non* Gill, 1859.

The genotype of *Rhinogobius*, Gill, 1859, is the Japanese *R. similis*, which has a larger mouth and higher dorsal than the Queensland species. *Fusigobius*, Whitley, 1930, has a more pointed head and different fin-outlines. The genus *Ctenogobius*, Gill, 1858, is West Indian and need not be considered here; *Coryphopterus*, Gill, 1863, is also a New World genus. The filiform dorsal spine and the large lateral blotches of *Gobius criniger* apparently distinguish it from *Porogobius*, Bleeker, 1874, and the colours and formulae of *Gobius schlegeli*, Günther, from the Gold Coast, the genotype of *Acentrogobius*, Bleeker, 1874, show that none of the genera associated with the "*Rhinogobius*" of Australian authors can be used for this species. It is therefore necessary to erect a new genus with *Gobius criniger*, Cuvier and Valenciennes, as type.

Named in honour of Dr. C. M. Yonge, leader of the Great Barrier Reef Expedition.

Yongeichthys criniger (Cuvier and Valenciennes).

Gobius criniger, Cuvier and Valenciennes, Hist. Nat. Poiss. XII, March, 1837, p. 82; Port Dorey, New Guinea (Quoy and Gaimard).

Gobius festivus, De Vis, Proc. Linn. Soc. N.S.W. IX, 29th November, 1884, p. 687; Cape York, Queensland (Broadbent).

Rhinogobius nebulosus, McCulloch and Ogilby, Rec. Aust. Mus. XII, 1919, p. 245; not *Gobius nebulosus*, Forskål, Descr. Anim. 1775, p. 24, from the Red Sea.

The Queensland fish called *Rhinogobius nebulosus* by Jordan and Seale, McCulloch and Ogilby, and Australian authors, would more appropriately assume the specific name of *Gobius criniger* supplied by Cuvier and Valenciennes, as its fin-counts differ from those of *Gobius nebulosus*, Forskål.

A specimen of *Yongeichthys criniger* (IA.4351) was found in a shallow pool amongst mangroves, 10th September, 1928. Others were seen entering burrows in the mud which had been made by crustaceans. One fish might enter several burrows in succession. It would protrude its head from a hole and wait and watch for several minutes, then, flicking a puff of sand, would swim away.

Yongeichthys leftwichi (Ogilby).

Rhinogobius leftwichi, Ogilby, Proc. Roy. Soc. Qd. XXIII, 7th November, 1910, p. 24; Great Sandy Strait, Queensland; McCulloch and Ogilby, Rec. Aust. Mus. XII, 1919, p. 248, pl. xxxiv, fig. 3 (topotype).

One (IA.4354), near mangroves, Low Isles, 29th August, 1928.

Genus *Priolepis*, Cuvier and Valenciennes, 1837.

Priolepis, Cuvier and Valenciennes, Hist. Nat. Poiss. XII, March, 1837, p. 67. *Ex* Ehrenberg MS. Genotype, *P. mica* (Ehr.) Cuvier and Valenciennes, a Red Sea variety of the Pacific *Gobius semidoliatus*, Cuvier and Valenciennes.

Zonogobius, Bleeker, Arch. Néerland Sci., IX, 1874, p. 323. Genotype, *Gobius semifasciatus*, Kner (*fide* Jordan, Gen. Fish. III, 1919, p. 374).

Priolepis, Cuvier and Valenciennes, should replace *Zonogobius*, Bleeker. In his Genera of Fishes, Jordan (p. 373) remarked that Bleeker, in his Esquisse (1874), which is not available to me, made *Priolepis* equivalent to *Asterropteryx*, Rüppell, but Cuvier and Valenciennes' brief account suggests that *Priolepis* is distinct, as the characteristic bands are mentioned and these are not present in *Asterropteryx*. Hemprich and Ehrenberg figured *Priolepis micans* in their Symbolae Physicae, which I have not seen, and Boulenger (Zool. Rec., 1899 [1900], p. 24) notes the identity of this species with *Gobius semidoliatus*, Cuvier and Valenciennes.

Priolepis nuchifasciatus (Günther).

Three specimens (IA.4355) from Low Isles. Very sluggish, and may be caught by hand.

Beetroot-red in life as in Herre's figure of *Z. semidoliatus* (Monog. Philipp. Bur. Sci. XXIII, 1927, pl. xxx, fig. 2), but this colour fades away after death. McCulloch, in manuscript, noted the life-colours of Masthead Island specimens as " scarlet, brightest on the head, which is marked with thin bluish-white, dark-edged lines. Scales dark-edged. Dorsals, caudal, and anal with several rows of scarlet spots." The late Dr. W. E. J. Paradice noted the colours of Cumberland Islands specimens (IA.2377) as follows :

> " Locality : Cumberland Is., Great Barrier Reef. Blown up in three fathoms near rocks. At a distance the small fish appears reddish brown all over, but considerably lighter in the pectoral region than elsewhere. On close examination it is seen that each scale has an almost colourless centre and is outlined with reddish brown. The head is reddish brown with the brown predominating whilst in the tail the red predominates, the transition of colour being gradual and uniform. No outlines of scales can be detected by the naked eye anterior to the origin of the dorsal fin, and the head is marked by several white transverse bands, the edges of which are clearly defined by a line of brown slightly darker than the ground-colour of the head. The unpaired fins (including tail) have zig-zag lines of reddish brown crossing a colourless ground. The pectorals are almost colourless and the ventrals brown with a white edge."

Subfamily *Gobiodontinae*.

Genus *Gobiodon*, Bleeker, 1856.

Gobiodon unicolor (Castelnau).

Ellerya unicolor, Castelnau, Proc. Zool. Acclim. Soc. Vict. II, 10th May, 1873, p. 95 ; Eclipse I., Cape Sidmouth, Queensland.

Ellyria (*sic*), Castelnau, Offic. Rec. Philad. Exhib. Melb. 1875, p. 21.

Gobiodon verticalis, Alleyne and Macleay, Proc. Linn. Soc. N.S.W. I, March, 1877, p. 333, pl. xii, fig. 4. No locality (= Darnley I., Qd.). Types in Macleay Museum, University of Sydney; McCulloch and Ogilby, Rec. Aust. Mus. XII, 1919, p. 208, pl. xxxii, fig. 2 (Green I., Qd.); Whitley, Rec. Aust. Mus. XVI, 1927, p. 28 (Michaelmas Cay, Qd.).

Gobius douglasi, Saville-Kent, Gt. Barrier Reef, 1893, p. 310, chromo-pl. xvi, fig. 12; Thursday I., Qd.

Two specimens (IA.4066) from Batt Reef agree with Castelnau's description; his name has precedence over *G. verticalis*, Alleyne and Macleay. The types of the latter came from Darnley Island, not New Guinea as stated by authors. This species is common amongst coral on the Great Barrier Reef.

Genus *Paragobiodon*, Bleeker, 1873.

Paragobiodon echinocephalus gibbosus (Macleay).

Gobius echinocephalus, Rüppell, Atlas zu der Reise im N. Afrika (Senckenb. Nat. Ges.) Fische, 1830 *vel* 1831, p. 136, pl. xxxiv, fig. 3 (*ex* Ehrenberg MS.); Massowah, Red Sea.

Gobius gibbosus, Macleay, Proc. Linn. Soc. N.S.W. V, 20th May, 1881, p. 601; Endeavour R., Queensland. Type in Macleay Museum, University of Sydney.

Gobius scabriceps, Macleay, Proc. Linn. Soc. N.S.W. V, 10th May, 1881, p. 603; Endeavour R., Queensland. Type in Macleay Museum, University of Sydney.

Paragobiodon echinocephalus, McCulloch and Ogilby, Rec. Aust. Mus. XII, 1919, p. 239, pl. xxxiv, fig. 1 (references and synonymy); Whitley, Aust. Zool. IV, 1926, p. 205, and Rec. Aust. Mus. XVI, 1927, p. 28; Herre, Monog. Philipp. Bur. Sci. XXIII, 1927, p. 172, pl. xiii, fig. 2 (Philippines); Whitley, Rec. Aust. Mus. XVI, 1928, p. 301; Fowler, Mem. Bishop, Mus. X, 1928, p. 399.

A common species amongst coral, and very variable in colour. In several parts of Queensland I have noted its preference for *Seriatopora hystrix*, and observed this also at Batt Reef.

Five (IA.4067 and IA.4462) from Batt Reef.

Family PERIOPHTHALMIDAE.

Genus *Euchoristopus*, Gill, 1863.

Euchoristopus kalolo (Lesson).

A few specimens (IA.4352–4343) of this common mangrove fish were preserved for identification. I am using Lesson's specific name, which has priority over that of Cuvier and Valenciennes.

On 27th May, 1770, this species was observed by members of the crew of the "Endeavour" in what is now Queensland (Hawkesworth, Account Voy. S. Hemisph., ed. 1, 1773, III, p. 529), and no visitor to the tropical mangrove swamps can fail to be impressed by this interesting fish.

Family SCORPAENIDAE.

Subfamily *Scorpaeninae.*

Genus *Sebastapistes,* Streets, 1877.

Sebastapistes bynoensis laotale, Jordan and Seale.

Sebastapistes laotale, Jordan and Seale, Bull. U.S. Bur. Fish, XXV, 15th December, 1906, p. 376, fig. 72; Apia, Samoa.
Sebastapistes bynonesis, Whitley, Rec. Aust. Mus. XVI, 1927, p. 29; Michaelmas Cay, Qd.

Two specimens (IA.4435–4436) from Low Isles; caught by Mr. F. W. Moorhouse, 29th September, 1928.

Subfamily *Pteroinae.*

Genus *Brachirus,* Swainson, 1839.

Brachirus, Swainson, Nat. Hist. Fish. Amphib. Rept. II, July, 1839, p. 71 = *Brachyrus,* Swainson, *ibid.,* p. 264. Genotype, *B. zebra* (Cuvier and Valenciennes) (= *Pterois zebra,* Quoy and Gaimard), selected by Swain, Proc. Acad. Nat. Sci. Philad. 1882 (1883). p. 277. Not *Brachirus,* Swainson, *ibid.,* pp. 187 and 303, a genus of Soles.
Dendrochirus, Swainson, Nat. Hist. Classif. Fish. Amphib. Rept. II, July, 1839, p. 180, *Genus caelebs.* Genotype, *Pterois zebra,* Cuvier and Valenciennes (= Quoy and Gaimard), designated by Jordan and Evermann, Bull. U.S. Fish. Comm. XXIII, 1903 (1905), p. 465.

As *Brachirus* is apparently not preoccupied or otherwise invalidated, it must take precedence over *Dendrochirus.*

Brachirus zebra (Quoy and Gaimard).

One small specimen (IA.4434) was caught at Low Isles 1st September, 1928.

Genus *Pterois,* Schinz, 1822.

Pterois volitans (Linné).

Noted from Low Isles by Yonge (A Year on the Great Barrier Reef, 1930, p. 96), but not seen from that locality by the writer.

Family SYNANCEJIDAE.

Genus *Synanceja,* Bloch and Schneider, 1801.

Synanceja trachynis, Richardson.

(Plate IV, figs. 1, 2).

For the taxonomy, synonymy, and bibliography of this species, see my Ichthyological Miscellanea (Mem. Qd. Mus. X, 1930, p. 25). Probably the "*Batrachus*" of MacGillivray (Narr. Voy. "Rattlesnake," I, 1852, p. 198) is referable to this species.

D. xiii/7 ; A. iii (rudimentary)/6 ; P. 16 ; V. i/5 ; C. 9 main branched rays.

Head, measured from symphysis of upper jaw to opercular flap (95 mm.), 2·2 in standard length (209). Depth, at origin of dorsal (90), 1·2 in width at opercles (109). Eye (9) 2·6 in width of supraorbital bosses (24). Ventral fin (50) nearly equal to pectoral base (52). Depth of caudal peduncle (22) 1·5 in length of caudal (34).

Head about as broad as long, but longer than deep. A shield-shaped nuchal bony process with two smaller similar approximate crests adjoining a diamond-shaped depression on each side of the nape. A deep saddle-shaped concavity between dorsal fin and eyes, over each of which there is an excrescence where the frontal bones form a supraorbital boss. A deep concavity above and between the eyes. Upper surface of snout subhorizontal. Below each eye, over the cheek, there is a deep hemispherical depression. Preopercular stay produced into a large bony knob below each eye. A series of bony ridges along each preorbital which ends in two sharp processes, the anterior of which is covered by a fleshy lobe.

Preopercular margin rounded, with five or six lobes and a large flesh-covered spine. Opercular margin oblique, lobed, with a blunt flap superiorly and a projecting rounded bony inferior process.

Gill-openings wide, separated by a broad isthmus. Branchiostegal membranes covered with fatty tissue. Four gill-arches ; no slit behind the fourth. A series of close-set rudimentary gill-rakers like papillae.

Cleft of mouth almost vertical, gape wide. Premaxillary arc-shaped, its width subequal throughout its length. Maxillary with a broad truncate margin and the angles rounded. A concavity on each side between chin and mandible. A band of small, close-set, pointed teeth in each jaw, separated by a fleshy process at each symphysis. A velar flap in both jaws. An inconspicuous patch of teeth on the vomer but none on palatines. A large oval patch of teeth, on each side, above and below, before the pharynx ; the lower patches are in advance of the upper, and bear smaller teeth. Tongue broad and fleshy, with a rounded margin. Head covered with a thick skin, without scales. The skin is produced into fimbriae around the mouth, and gives rise to wart-like protuberances on opercles and chin.

Body rounded anteriorly, compressed posteriorly, and with a bag-like belly. The skin is thick, wrinkled and with large wart-like processes, which are largest on the back and sides, and not nearly so plentiful under the pectoral. The thick skin extends over the fins and almost obliterates many of the rays. There is a row of warts along each side of the dorsal and one wart on each side of the root of the tail ; other warts occur on the upper surface of the pectorals.

Dorsal originating vertically over preopercular spine. The first three spines are long, spaced, and slightly distinct from the remaining ten. Each spine is sharp and provided with a venom-sac on each side, but all but the tip of each spine is concealed by thick skin which is noticeably lobed on the anterior spines. Second dorsal short, but with the median rays longer than any of the spines. The last dorsal ray is connected to the caudal peduncle by a thick membrane which is just distinct from the caudal. Anal with three rudimentary spines like fleshy fingers ; soft portion of fin similar to soft dorsal, and connected to the caudal peduncle in the same way, but more anteriorly. Pectorals broad and muscular, with the skin of the under-surface smooth. The nine lowest rays are thick and like curved fingers, but the uppermost rays are branched and almost hidden by the thick integument. Ventrals stumpy, with a long base; the rudimentary spine and first two or three rays are finger-like, and a broad membrane connected the fifth ray of each ventral fin to the belly. There are hardly any warts on or between the ventral fins. Caudal broad, regularly fan-shaped, with a rounded margin.

The general colour in formalin is rusty brownish, marbled with grey, which becomes the predominating colour on the top of the head and back, and on the larger warts. The greyish marbling tends to form bars or reticulations on the fins, which are of a darker brown towards their margin. There is a sea-green tinge suffusing the grey marbling on the bony prominences of the head and on the light ground-colour of the cheeks. A dark brown diamond-shaped concavity on the nape bears a superficial resemblance to an eye, as does also a brown patch in the hemispherical concavity below the true eye. Snout, jaws, and velar flaps in mouth spotted with brown. Interior of mouth white; bands of teeth yellowish.

Described and figured from a Stonefish nearly 10 in. long. Australian Museum registered number IA.4057.

This specimen has already figured in popular articles on the Great Barrier Reef Expedition*; it was collected on the reef near the mangroves at Low Isles under the following circumstances which are described in my field notes:—

24th September, 1928: I was about to turn over a piece of coral when something between it and a gaping clam attracted my attention. This object was so like a piece of eroded rock that I had to examine it closely before realizing that it was in reality a stonefish. I touched it with a stick and the three anterior dorsal spines were erected immediately. The fish was absolutely still and its misshapen head, of a lemon-yellow colour in life, was pockmarked with grey, which heightened its resemblance to the yellowish madrepores from which its head and foreparts were protruding. The dorsal spines were yellowish, with their investing integument puckered into fronds and frills. The eyes had tiny black pupils surrounded by a variegated iris whose surface appeared pimpled. The hinder parts of the body and the thick pectorals were partly hidden, but appeared yellowish with reddish wart-like processes. The mouth was kept tightly shut, but I pushed it open with a piece of coral and noted the inside as white with blackish markings. Only the upper part of the gill-slit appeared to be opened and closed and that almost imperceptibly, a small current of water being ejected at intervals of about four seconds. The edge of the gill-slit was finely fimbriated so as to look as if fringed with algae. A photograph of this Stonefish, taken *in sitû* by Mr. W. Boardman, is reproduced here.

Molluscs crawled over the stonefish's rock-like head and some prawns even walked over its mouth but the stonefish paid no attention to them. The head, body and fins were covered, as is usual in this species, with a thick coating of brown or greenish-brown slime. The specimen was netted and kept alive for some hours in a bucket of water, but it died overnight.

The colours of a specimen from Thursday Island (Austr. Mus. regd. no. IA.2046), sent to Sydney in ice, were noted as follows:

The dominant colours of this specimen are scarlet and grey which form an anastomosing pattern. The greater part of the head and back is grey, closely speckled with more or less rounded spots, defined by darker lines around their edges. On the head the spots are largely brown above and red below, but on the back they are dark red anteriorly, changing to scarlet posteriorly. The sides of the body are principally scarlet, this colour being broken up by a grey, dark-edged, reticulating pattern. These colours become lighter below and change gradually into white on the belly. The sub-ocular cavity has a large black central spot, surrounded by others of lighter tint and separated by whitish lines; the whole bears some resemblance to a large eye. The cavity on each side of the occiput is black; another black blotch covers the base of the upper opercular spine, and less definite darker areas occur on the maxillary bone and between the preopercular spines. The dorsal fin is grey, with scarlet spots like the back, and a darker margin; the soft dorsal has a broad dark margin and is crossed obliquely by an irregular whitish streak. The anal fin is lighter basally, but is somewhat similar to the soft dorsal. Pectoral largely scarlet, with a dark purplish margin, and the whole fin is covered with numerous irregular whitish sub-reticulate lines. Caudal scarlet at base, changing to dark-purplish towards the margin, and is crossed by numerous white or grey lines with darker edges, of which a broad one across the middle of the fin is most conspicuous. Ventral yellowish basally, the rays scarlet, and the membrane between their tips dark purple; a series of broad white dark-edged spots crosses the rays about the middle of the fin, and there are several light circular spots. Gill membranes white. Chin and throat with grey and scarlet markings similar to the rest of the head. Inside of mouth pure white, but tinged with green on the inner surface of the lips.

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* Tandy, Nat. Hist. Mag., London, II, 1929, p. 89, fig. 11; Whitley and Boardman, Aust. Mus. Mag. III, 1929, p. 369, with frontispiece and photo in text; Yonge, A Year on the Great Barrier Reef, 1930, p. 94, pl. xxix, fig. c. All these articles deal with the identical specimen.

Total length, 305 mm.

Genus *Synanceichthys*, Bleeker, 1863.

"*Spurco*," Cuvier and Valenciennes, Hist. Nat. Poiss. IV, November, 1829, p. 452; *ex* Commerson MS., non-binomial. One species (*Scorpaena brachion*, Lacepède, = *Synanceichthys verrucosus*).

Synanceichthys, Bleeker, Ned. Tijdschr. Dierk. I, 1863, p. 234. Type, *Synanceja verrucosa*, Bloch and Schneider (*fide* Jordan, Classif. Fish. 1923, p. 210).

Emmydrichthys, Jordan, Proc. Calif. Acad. Sci. (2), VI, 1st March, 1897, p. 221; *ex* Jordan and Rutter MS. Genotype, *E. vulcanus*, Jordan.

Deleastes, Seale, Occ. Pap. Bishop. Mus. IV, 1, 1906, p. 80. Genotype *D. daector*, Seale. Not *Deleaster*, Erichson, 1839, a genus of Coleoptera. Said to have "smaller ventrals, situated more posteriorly than in *Synanceia*, . . . skin smooth."

Synanceja, Jordan, Gen. Fish. III, 1920, p. 374. Type wrongly regarded as *S. verrucosus*. Not *Synanceja*, Bloch and Schneider, *sensu stricto*.

I follow Jordan in using *Synanceichthys* for this genus as I am unable to consult Bleeker's original definition (Ned. Tijdschr. Dierk. I, 1863, p. 234).

Synanceichthys verrucosus (Bloch and Schneider).

Mr. F. W. Moorhouse collected a Stonefish on Batt Reef which I identified as *Synanceichthys verrucosus*. It had the interorbital broad, deeply concave. Mouth broad. No prominent processes on preoperculum. Base of pectoral longer, head broader and caudal smaller than in the *Synanceja trachynis* from Low Isles. Chin broad. Ventrals reaching well towards anal. Pharyngeal teeth in large patches.

This Stonefish is apparently not nearly so common on the Great Barrier Reef as *Synanceja trachynis*.

Specimens are in the Australian Museum from—
Murray I., Queensland,
Suva, Fiji,
Malay Archipelago (Day Coll.), and
Bougainville I., Solomon Group.

Family PLATYCEPHALIDAE.

Subfamily *Inegociinae.*

Genus *Suggrundus*, Whitley, 1930.

Subgenus *Repotrudis*, Whitley, 1930.

Suggrundus (*Repotrudis*) *macracanthus* (Bleeker).

One specimen (IA.4344) dredged in 12 fathoms, off Low Isles, 16th, October, 1928, by Mr. A. A. Livingstone.

Family BALISTIDAE.

Genus *Balistapus*, Tilesius, 1820.

Subgenus *Rhinecanthus*, Swainson, 1839.

Balistapus (*Rhinecanthus*) *aculeatus* (Linnaeus).

Specimens (IA.1622) from Low Isles were collected by Dr. W. E. J. Paradice as well as by members of the Expedition (IA.4053, 4089, 4499). These agree in detail with the description of *Balistes aculeatus* by Linnaeus (Syst. Nat., ed. 10, 1758, p. 328). Other specimens are in the Australian Museum from Two Isles and Masthead Islet, Queensland; Port Moresby, Papua; Vanikoro, Santa Cruz Group; Vate and Aneiteum, New Hebrides; Samoa; Fiji; Bougainville Island, Solomons. This species is common in the coral waters of the Pacific.

Family OSTRACIIDAE.

Genus *Lactoria*, Jordan and Fowler, 1902.

Lactoria cornutus (Linnaeus).

One (IA.4500) caught whilst it was swimming around a block of *Porites* coral on Batt Reef, 13th September, 1928.

Family TETRAODONTIDAE.

Genus *Ovoides*, Anonymous, 1798.

" *Les Ovoïdes*," Lacepède, Hist. Nat. Poiss. I, 1798, p. 520. Haplotype, " Ovoïde fascé " from " La mer des Indes." Vernacular name only.

Crayracion, Walbaum, Artedi, Ichthyol. (3), ed. 2, 1792, p. 580; *ex* Klein, non-binomial. Name not acceptable.

Ovoïdes, Anonymous, Allg. Lit. Ztg. (Jena), No. 287, 1798, p. 674 (*fide* Jordan, Classif. Fish, 1923, p. 240). Genotype, *Ovum commersoni*, Bloch and Schneider, by present designation.

Ovoides, Cuvier, Leçons Anat. Comp. I, 1800, Table IV, *nomen nudum*.

Ovum, Bloch and Schneider, Syst. Ichth., 1801, p. 530. Genotype, *O. commersoni*, Bloch and Schneider, based on " L'Ovoïde fascé " of Lacepède. Not *Ovum*, Martini, 1774, a non-binomial genus of mollusca (*teste* Mr. T. Iredale).

Oonidus, Rafinesque, Analyse de la Nature, 1815, p. 90. *Fide* Sherborn, Index Anim.

Ooides, Agassiz, Nomencl. Zool. 1846, Index Univ. Emend. pro. " Ovoïdes " Lacepède.

Crayracion, Bleeker, Atlas Ichth. VI, 1872, p. 49. Revival of a non-binomial name proposed by Klein, 1777. Genotype, *C. laevissimus*, Bleeker, based on Klein.

Tetraodon, Linnaeus (Syst. Nat., ed. 10, 1758, p. 332, genus 165. Genotype, *T. lineatus*, Linnaeus [spelt " *Tetrodon* " by Linnaeus, 1766] from the Nile), has recently been restricted to fluviatile species. *Ovoides* is here used for the Indo-Pacific Puffer-fishes of the *stellatus* and *aerostaticus* group with the body spotted, and the distensible belly with dark stripes (at least in the young).

Ovoides aerostaticus otteri, var. n.

(Plate III, fig. 2.)

Tetraodon aerostaticus, Jenyns, Voy. " Beagle," Fish, 1842, p. 152. Locality unknown. Said to have no lateral line ; Jordan and Seale, Bull. U.S. Bur. Fish, XXV, 1906, p. 368.

Crayracion lineatus, Bleeker, Atlas Ichth. V, 1872, p. 70, pl. ccvi, fig. 1, and pl. ccxii, fig. 1 (plates published 1865) ; East Indies. Not *Tetrodon lineatus*, Linnaeus, 1758, from the Nile.

Tetrodon stellatus, Günther, J. Mus. Godeffroy, VI, 17 (Fische de Südsee, IX), 1910, p. 465, pl. clxvi, fig. B. Gesellschafts Ins. Not *T. stellatus*, Bloch and Schneider, 1801, from Mauritius.

One (IA.4494), 101 mm. in standard length, from Batt Reef, agrees in general features with Bleeker's figure on pl. ccvi, and differs from Jenyns' description in having a well-marked lateral line system. *Tetrodon amabilis*, Castelnau (Proc. Linn. Soc. N.S.W., III, 1879, p. 401), is a distinct species from New South Wales characterized by its orange ground-colour. In *Tetraodon calamara*, Rüppell (Atlas zu der Reise im N. Afrika [Senckenb. Nat. Ges.], Fische, 1829, p. 64, pl. xvii, fig. 1 ; Red Sea), the eye is about 3 in snout whereas it is only about 2 in the Batt Reef specimen. As the Queensland form is evidently unnamed, I have much pleasure in associating the name of Mr. Guy Otter, one of the Zoologists of the Expedition, with this novelty.

Colours when Fresh.—Back dark brown, lighter on sides and becoming whiter on the belly, which is tinged with yellow ochre ventrally. Head, back, sides and tail densely sprinkled with blackish spots, which are smallest on the back and largest on the tail. The belly is streaked with broad irregular black markings. Gill-opening bluish black and each pectoral fin surrounded by a black ring. Pupil bluish, iris coppery. Dorsal and anal fin-rays smoky yellowish. Some parts of sides darker than others. Vent surrounded by a black spot. Lips greyish.

Ovoides implutus (Jenyns).

? *Tetraodon hispidus*, Linnaeus, Syst. Nat. ed. 10, 1758, p. 333. Based on Chin. Lagerstr. 23 and Artedi, gen. 58, syn. 83 ; India.

Tetrodon implutus, Jenyns, Zool. Voy. " Beagle," Fish, 1842, p. 152 ; Keeling Islands.

Crayracion laterna, Bleeker, Atlas, Ichthy. VI, 1865, pl. ccv, fig. 3 ; *ibid.*, 1872, p. 71, as *C. implutus*.

Tetraodon hispidus, McCulloch, Mem. Aust. Mus. V, 1929, p. 428, and of Australian authors generally.

Tetraodon, Yonge, A Year on the Great Barrier Reef, 1930, p. 88, pl. xxix, fig. A (Low Isles, Qd.).

Great Barrier Reef specimens in the Australian and Queensland Museums have no arc-shaped markings around eyes and have the cheeks and chin with light spots on a dusky ground, agreeing with Bleeker's figure, but not with any in Day's Fishes of India.

Two specimens (IA.4492, 4493) from Low Isles. This species can move either eye independently of the other; it does not unfold the caudal fin very much when swimming, thereby resembling the Aluterid fishes.

Ovoides manillensis (Procé).

Tetrodon manillensis, Procé, Bull. Soc. Philom., Paris, September, 1822, p. 130; Manila, Philippine Is.
Tetraodon immaculatus, Jordan and Seale, Bull. U.S. Bur. Fish. XXV, 1906, p. 370 (references). Not *T. immaculatus*, Bloch and Schneider, 1801.

Three (IA.4495, 4496 and 4497) from Low Isles, where the species was common. Body striped and with prickles capable of penetrating the hand in contrast to the almost smooth integument of *O. implutus*. Future study, with more specimens, may show that the two species should be subgenerically separated.

INDEX

PAGE
Acanthochaetodon 288
Acentrogobius 303
Actinicola 289
aculeatus, Balistapus 310
aculeatus, Balistes 310
aerostaticus, Tetraodon 311
albirostris, Corythoichthys 273
Alticus 297
amabilis, Tetrodon 311
Amblygobius 302
amboinensis, Pseudopomacentrus 291
Amphacanthidae 289
Amphacanthus 289
Amphiprion 289
Amphiprionidae 289
Anarchias 271
antjerius, Glyphisodon 292, 293
Apogonidae 283
aroubiensis, Apogon 283
Arrhamphus 277
aruanum, Tetradrachmum 293
aruensis, Valenciennea 300
Aspiscis 284
Asterropterix 300, 304
Atherina 278
Atherinidae 277
Atherion 278
australis, Serranus 282

Balistapus 310
Balistidae 310
Bathygobius 302
Batrachoididae 300
bennetti, Chaetodon 288
bennetti, Rabdophorus 288
Bhanotichthys 274
bicinctus, Amphiprion 289
biocellatus, Abudefduf 292
biocellatus, Glyphidodontops 292
biocellatus, Glyphisodon 292
blochii, Cheilinus 294
Bodianidae 295
brachion, Scorpaena 309
Brachirus 306
Brachyrus 306
brownrigii, Chaetodon 283
bynoensis, Sebastapistes 306

caeruleopunctatus, Epinephelus 281
caeruleopunctatus, Holocentrus 281
PAGE
caeruleus, Hoplochromis 293
calamara, Tetraodon 311
Calleleotris 300
Callionymidae 296
Callionymus 296
calliste, Callionymus 296
cancellata, Muraena 271
cancellata, Thyrsoidea 271
cancellatus, Gymnothorax 271
cephalozona, Ophichthys 270
Chaetodontidae 286
Cheilolabrus 294
chlorourus, Labrus 294
Choerodon 295
Chromidae 293
Chromis 293
Cirripectus 297
clarkii, Amphiprion 290
clarkii, Anthias 290
Clupeidae 270
coelestinus, Glyphisodon 292
coma, Equula 286
commerson, Scomberomorus 289
commersoni, Ovum 311
commersonii, Farhians 276
commersonii, Hemiramphus 276, 277
conspicillatus, Syngnathus 274
cookii, Apogon 283
cookii, Lovamia 283
corallicola, Epinephalus 282
corallicola, Serranus 282
Coridae 294
cornutus, Lactoria 310
Coryphopterus 303
Corythoichthys 273
Corythroichthys 273
Coryzichthys 300
Crayracion 310, 311
Crenalticus 297, 298
criniger, Gobius 302, 303
criniger, Yongeichthys 303
Ctenogobius 303
cylindrica, Paraparcis 296

daector, Deleastes 309
darnleyensis, Bathygobius fuscus 302
darnleyensis, Gobius 302
Dasyatidae 269
Deleastes 309
delicatus, Mugil 280, 281

PAGE
Dendrochirus 306
diemensis, Coryzichthys 300
dispar, Zenarchopterus 277
Doryrhamphus 275
douglasi, Gobius 305

Echidna 271
echinocephalus, Gobius 305
echinocephalus, Paragobiodon 305
Ecsenius 297
edentula, Equula 285, 286
edentula, Scomber 286
Eleotridae 300
Ellochelon 279
Ellyria 304
Emmydrichthys 309
endekataenia, Apogon 283
Epinephelidae 281
Epinephelus 281
Equula 285
equula, Equula 285, 286
equula, Leiognathus 285
equula, Scomber 285
Euchoristopus 305
Eviota 301

Far 276
far, Hemiramphus 276, 277
Farhians 276
fasciata, Amia 283
fasciatus, Apogon 283
fasciatus, Blennius 298
fasciatus, Corythrichthys 274, 275
fasciatus, Hemigymnus 294
fasciatus, Mullus 283
fasciatus, Salarias 298
fasciatus, Syngnathus 274
festivus, Gobius 303
Fistularia 273
Fistulariidae 273
fistulosa, Foa 284
flavofasciatus, Corythoichthys 274, 275
flavofasciatus, Syngnathus 274
Foa 284
fulviflamma, Lutjanus 285
fuscus, Bathygobius 302
fuscus, Gobius 302
fuscus, Mapo 302
Fusigobius 303

Gergobius 300
Gerres 286
Gerridae 286
gibbosus, Gobius 305
gibbosus, Paragobiodon echinocephalus 305
gladius, Esox 276
Glyphidodontops 292
Glyphisodon 292

PAGE
Glyphisodontinae 292
Gobiidae 301
Gobiodon 304
Gobiodontinae 304
Gobius 301
gracilis, Sillago 284
granulata, Himantura 269
Guntheria 294
guttulatus, Coryzichthys 300
Gymnothorax 271

haematopterus, Syngnathus 275
halgani, Taeniura lymnia 269
Harengula 270
Hemicoris 294
Hemigymnus 294
Hemiramphidae 276
Hemiscylliidae 269
Hemiscyllium 269
Himantura 269
Hippichthys 273
hispidus, Tetraodon 311
hoevenii, Epinephelus 281
hoevenii, Serranus 281
Holacanthus 288
Hoplochromis 293
howlandi, Serranus 282
hypselopterus, Petroscirtes 298, 299

immaculatus, Tetraodon 312
implutus, Ovoides 311, 312
implutus, Tetrodon 311
Inegociinae 310
insuetus, Anarchias 272
interstinctus, Gobius 302
intestinalis, Corythroichthys 274
intestinalis, Hippichthys 274, 275
intestinalis, Syngnathus 274, 275
irroratus, Negoscartes 298
Istigobius 301

japonicus, Callionymus 297
Julidae 294

kalolo, Euchoristopus 305
knighti, Anarchias 272
kunhardtii, Serranus 281

Labridae 294
Lactoria 310
lacunosa, Atherina 277, 278
laevissimus, Crayracion 311
laotale, Sebastapistes bynoensis 306
laterna, Crayracion 311
leftwichi, Rhinogobius 303
leftwichi, Yongeichthys 303
Leiognathidae 285
Leiognathus 285

PAGE

lineata, Calleleotris 300
lineata, Dormitator 300
lineata, Eleotris 300
lineatus, Amphacanthus 289
lineatus, Crayracion 311
lineatus, Rupiscartes 298
lineatus, Tetraodon 311
lineolatus, Salarias 298
littoralis, Pseudopomacentrus . . . 291
Lovamia 283
lunatus, Callionymus 297
lunula, Chaetodon 286
Lutjanidae 284
Lutjanus 284
lymnia, Taeniura 269

maccullochi, Atherion 278
macleayi, Pomacentrus 291
macleayi, Pseudopomacentrus 291
macleayi, Pseudopomacentrus wardi . 291, 292
macracanthus, Suggrundus 310
maculata, Tandya 296
maculatus, Gnathypops 296
maculatus, Gobius 301
maculatus, Opisthognathus 296
maculatus, Plectropomus 282
manillensis, Ovoides 312
manillensis, Tetrodon 312
margaritaceus, Octocynodon 294
marginalis, Gobius 302
marginatus, Esox 276
marginatus, Muraenopsis 270
marginatus, Ophisurus 270
marginatus, Zonophichthus 270
marmoratus, Uropterygius 273
Megaprotodon 288
melanopleura, Doryrhamphus 275
melanospilos, Gymnothorax 271
Melanotaeniidae 278
melapterus, Hemigymnus 294
meleagris, Crenalticus 298
merra, Epinephelus 282
Metagobius 302
mica, Priolepis 304
micans, Priolepis 304
microps, Callionymus 297
miniatus, Octocynodon 294
moar, Hemiramphus 276
Mugil 280
Mugilidae 279
Muraenidae 271
muralis, Calleleotris 300
muralis, Eleotris 300
muralis, Valenciennea 300

nebulosa, Echidna 271
nebulosus, Gobius 303
nebulosus, Rhinogobius 303

PAGE

Negoscartes 297, 298
nigrifilis, Eleotris 300
nigripinnis, Gobius 302
niomatus, Pseudopomacentrus . . 291, 292
nitidum, Tetradrachmum 293
nitidus, Chromis 293
novaeguinae, Pseudomugil 279
nuchifasciatus, Priolepis 304

obesus, Hemiramphus 276
obscura, Equula 285
obscura, Leiognathus 285, 286
obscurus, Pomacentrus 291
ocellatum, Hemiscyllium 269
Octocynodon 294
ogilbyi, Pranesus 277
Ooides 311
Oonidus 311
Ophichthiidae 270
Opisthognathidae 296
ornatus, Gobius 301
Ostraciidae 310
Ovoides 310, 311
Ovum 311
oyena, Labrus 286

pallida, Coris 294
pallida, Hemicoris 294, 295
palmeri, Glyphisodon 292
Paragobiodon 305
Parapercidae 296
Parapercis 296
percula, Actinicola 289, 290
Periophthalmidae 305
petimba, Fistularia 273
Petroscirtes 298
Petroscirtinae 298
phalaena, Amblygobius 302
picta, Siderea 273
pinguis, Atherina 277
pinguis, Hepsetia 277
Platycephalidae 310
plebeius, Chaetodon 288
plebeius, Megaprotodon 288
Plectropomus 282
Pomacentridae 290
Pomacentrinae 290
Porogobius 303
Pranesus 277
Priolepis 304
profundis, Clupea 270
Pseudomugil 278
Pseudopomacentrus 290
Pteroinae 306
Pterois 306
punctata, Harengula 270
punctulatus, Batrachus 296

PAGE
queenslandiae, Coryzichthys diemensis 300
queenslandica, Eviota viridis 301
quisqualis, Asterropterix semipunctatus 300

Rabdophorus 288
ranelayi, Clupea 270
Repotrudis 310
Rhinecanthus 310
Rhinogobius 303
robusta, Amia 283
robustus, Stolephorus 270
rubriniger, Serranus 282
Rupiscartes 297, 298

Salarias 297, 298
Salariidae 297
Salariinae 297
savayensis, Aspiscis 284
scaber, Callionymus japonicus 297
scabriceps, Gobius 305
schlegeli, Gobius 303
sclateri, Metagobius 302
sclerolepis, Arrhamphus 277
Scomberomoridae 289
Scomberomorus 289
Scorpaenidae 306
Scorpaeninae 306
sealei, Corythroichthys 275
Sebastapistes 306
semicirculatus, Holacanthus 288
semidoliatus, Gobius 304
semifasciatus, Gobius 304
semipunctatus, Asterropterix 300
sexstriatus, Holacanthus 288
Siderea 273
signata, Atherina 278
signatus, Pseudomugil 278, 279
signifer, Pseudomugil 278, 279
Sillaginidae 284
Sillago 284
similis, Rhinogobius 303
splendens, Gerres 286, 287
splendens, Mugil 280
Spurco 309
stellatus, Tetrodon 311
stephensoni, Gobius 301, 302
Stolephoridae 270
Stolephorus 270
Strongylura 275
subniger, Serranus 282
sufflavus, Pseudopomacentrus 290
Suggrundus 310
Synanceichthys 309
Synanceja 306, 309

PAGE
Synancejidae 306
Syngnathidae 273

Taeniura 269
taeniura, Calleleotris 300
Tandya 296
tegobuan, Mugil 281
terebra, Strongylura 275
Tetradrachmum 293
Tetraodon 311
Tetraodontidae 310
Tetrodon 311
Thalliurus 294
torresiensis, Clupea 270
trachynis, Synanceja 306–309
trilineatus, Pomacentrus 292
trimaculata, Guntheria 294
Trimma 301
Tylosurus 276

undulata, Lycodontis 271
undulatus, Gymnothorax 271
unicolor, Ellerya 304
unicolor, Gobiodon 304
unimaculatus, Lutjanus fulviflamma 285
Uropterygius 273

vagabundus, Chaetodon 288
vaigiensis, Ellochelon 279
vaiulae, Foa 284
valenciennesii, Callionymus 297
variegatus, Halichoeres 295
verrucosa, Synanceja 309
verrucosus, Synanceichthys 309
verticalis, Gobiodon 305
villosa, Atherina 278
viperidens, Petroscirtes 299
viperidens, Salarias 299
viridis, Allogobius 301
viridis, Eviota 301
volitans, Pterois 306

waitei, Corythroichthys 274, 275
wardi, Pomacantrus 291
wardi, Pseudopomacentrus 291
wardi, Pseudopomacentrus wardi 292

Yongeichthys 302, 303

zebra, Brachirus 306
zebra, Pterois 306
Zenarchopterus 277
Zonogobius 304
Zonophichthus 270
zonura, Eviota 301

DESCRIPTION OF PLATE I.

Fig. 1.—*Himantura granulata* (Macleay). A living specimen among mangrove roots at Low Isles. Australian Museum registered number IA.4477. Photograph by William Boardman.

Fig. 2.—*Actinicola percula* (Lacepède). A specimen swimming amongst the tentacles of a large sea-anemone (*Stoichactis*). The arrows in the margin point towards the fish. Photograph by William Boardman.

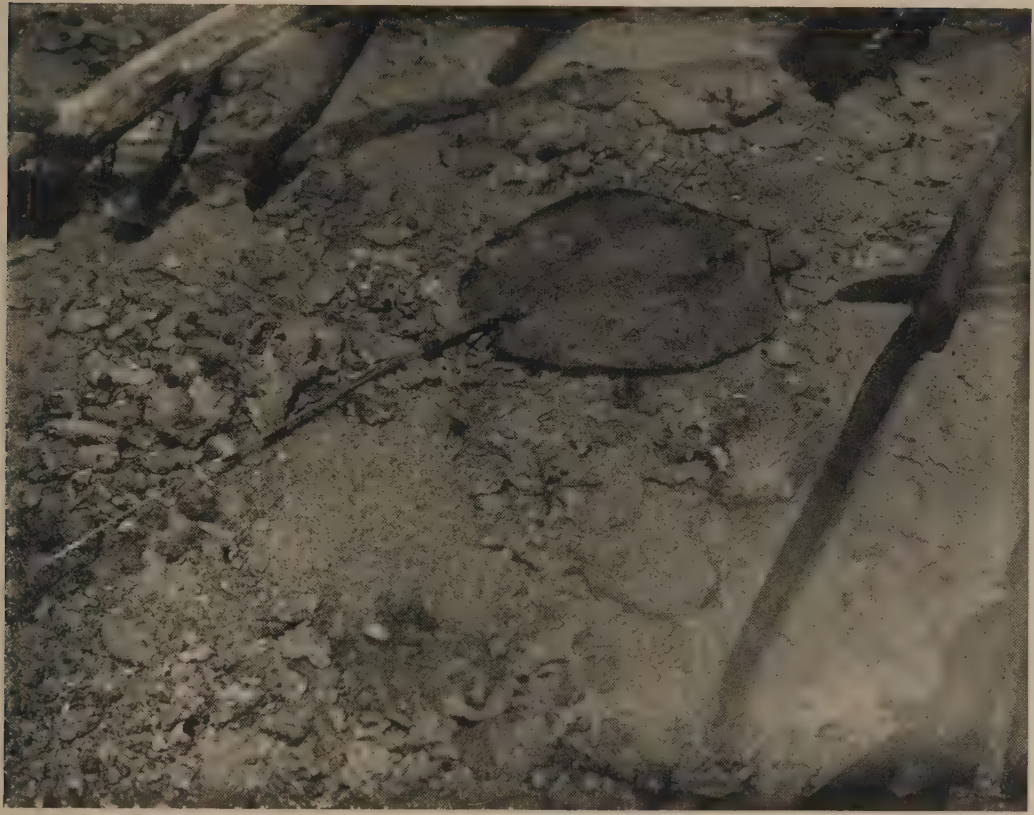


FIG. 1.

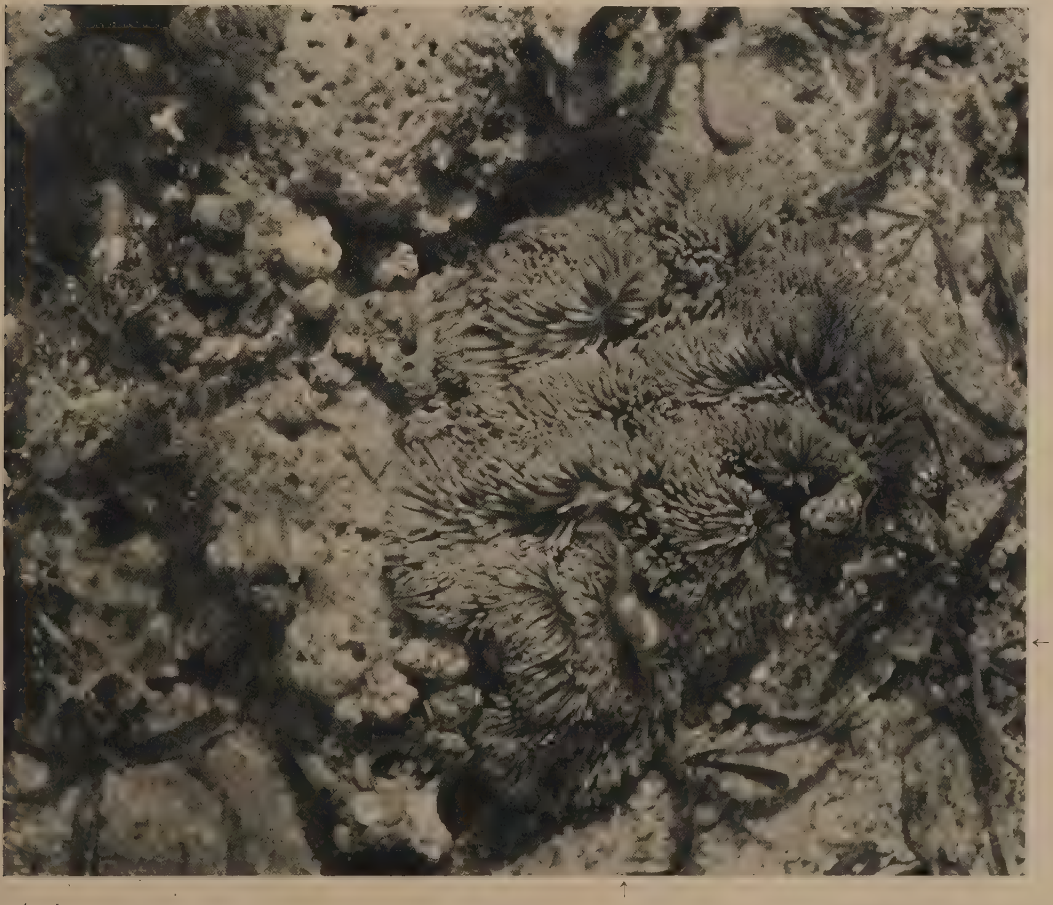


FIG. 2.

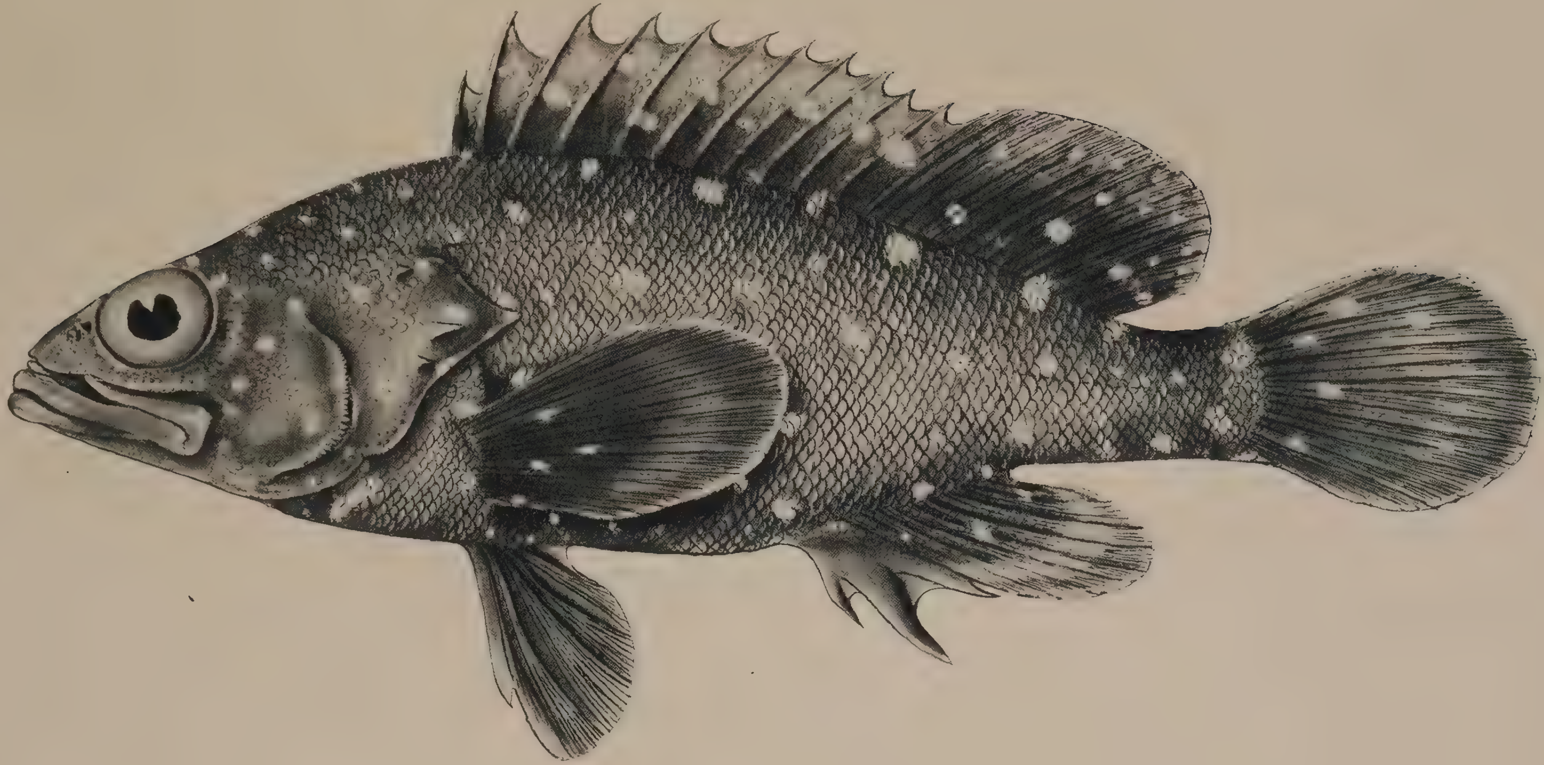
[*Adlard & Son, Ltd., Impr.*

DESCRIPTION OF PLATE II.

Fig. 1.—*Epinephelus hoevenii* (Bleeker). A specimen from Low Isles. Regd. no. IA.4426. Drawing by Miss Joyce K. Allan.

GREAT BARRIER REEF EXPEDITION 1928–29.

Brit. Mus. (Nat. Hist.). REPORTS, VOL. IV, NO. 9. PLATE II.



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DESCRIPTION OF PLATE III.

Fig. 1.—*Equula obscura* (Seale). A specimen from Low Isles. Regd. no. IA.4498. Drawing by Joyce K. Allan.

Fig. 2.—*Ovoides aerostaticus otteri*, var. n. Holotype of variety from Batt Reef. Regd. no. IA.4494. Drawing by Joyce K. Allan.

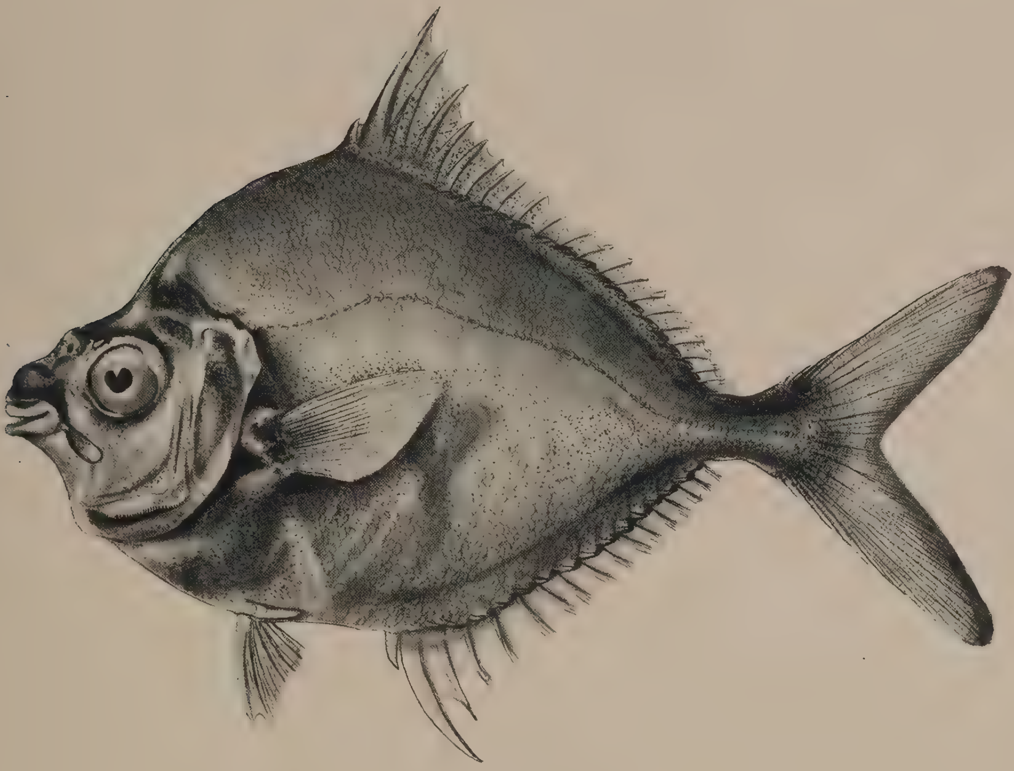

Fig. 1.

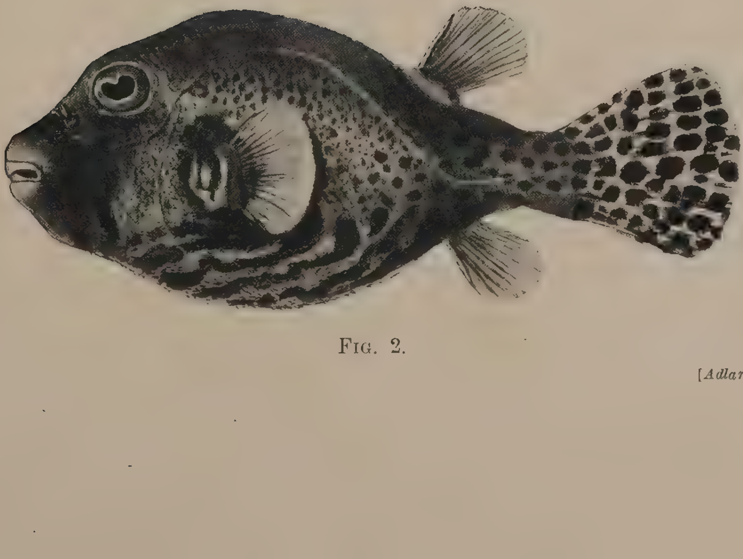

Fig. 2.

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DESCRIPTION OF PLATE IV.

Fig. 1.—*Synanceja trachynis*, Richardson. Living specimen *in sitû* amongst corals, a horseshoe clam, and other objects, showing its remarkable resemblance to its surroundings, in the moat at Low Isles. The arrows in the margin point towards the fish. Photograph by William Boardman.

Fig. 2.—*Synanceja trachynis*, Richardson. The same specimen as in fig. 1 removed from its natural surroundings. Low Isles. Regd. no. IA.4057. Photograph by William Boardman.

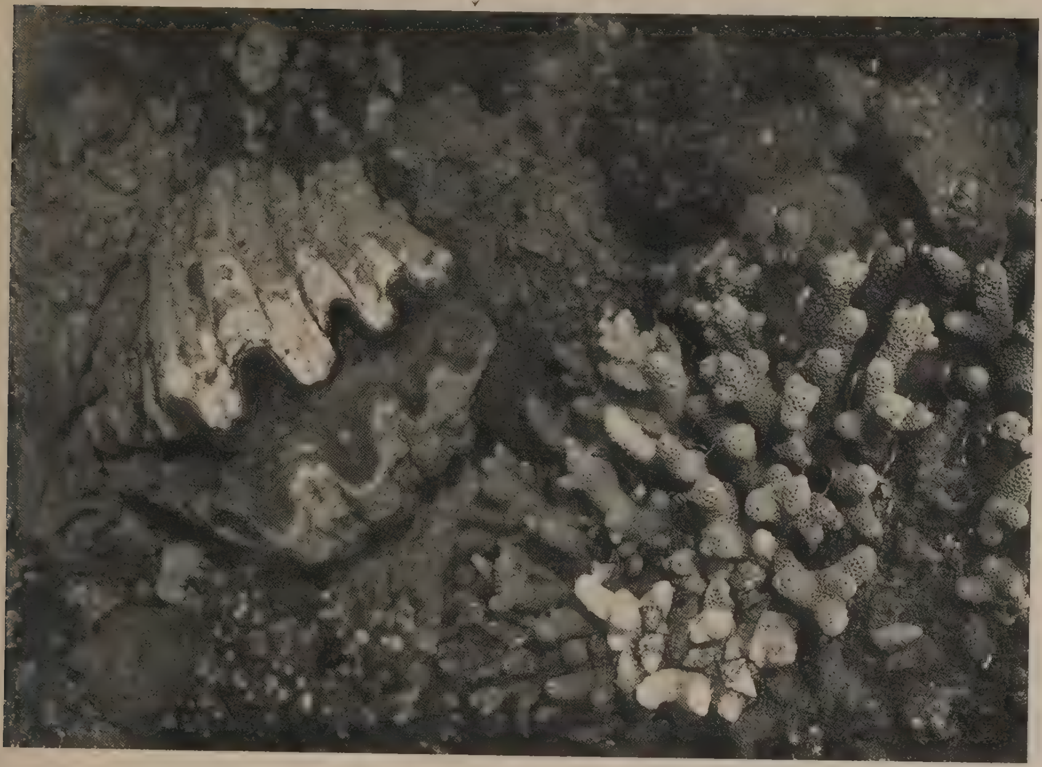

FIG. 1.

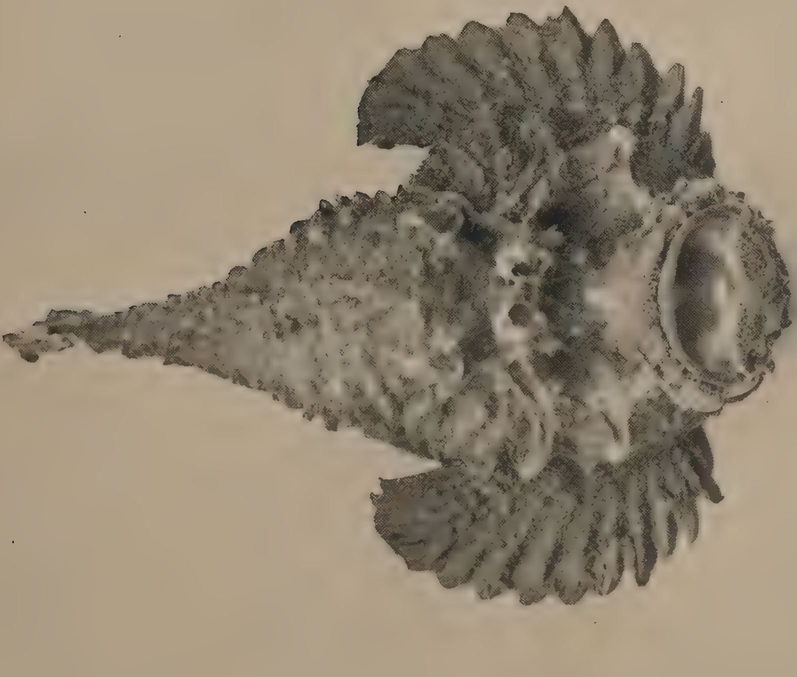

FIG. 2.

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SIPHONOPHORA

BY

A. K. TOTTON, M.C.,
Assistant Keeper in the Department of Zoology

WITH THIRTY-SIX TEXT-FIGURES

CONTENTS

PAGE
1. Introduction 317
2. List of Species 319
3. Description of Species 320
   Physophorae 320
   Calycophorae 327
4. References 372
5. Index 373

1. INTRODUCTION.

This report deals with the Siphonophora only from the systematic point of view. Their occurrence and distribution in the region of the Great Barrier Reef will be discussed in detail in the general reports on the zooplankton which are in preparation by Mr. Russell and Mr. Colman.

A remarkable fact about the Siphonophora is that, in spite of their individual abundance in all seas, the total number of known species is only about 120, made up of 40 Physophorae, 60 Calycophorae, 12 Rhizophysaliae, and 8 Chondrophorae. Of these, 4 Physophorae and 25 Calycophorae were taken by the Expedition. In addition two new species are published, and the capture of four unnamed species is recorded.

Some points to which attention is invited are the discussion of the taxonomic value of Monophyism; the suggested regrouping of the Sphaeronectids; some general notes on the nomenclature and classification of Prayids, and on the classification of certain Galeolariids; the erection of a new genus *Lensia* for a group of small forms like *Galetta subtiloides*; and a new and more natural grouping of species of *Diphyes*.

It is often difficult to identify from published figures and descriptions the detached parts of colonies which continue to lead an active, free existence, and are often found free in the plankton. It has been thought desirable, therefore, to record fully the shapes of the various bracts and swimming bells brought back by the Expedition.

It is regretted that it has been found necessary to give up the use of the names *Galeolaria* and *Cuboides*, and to introduce such new names as *Chelophyes* and *Lensia*, as well as to reintroduce the old names *Sulculeolaria*, *Enneagonum* and *Eudoxoides*.

Terminology has been reviewed recently by Moser (1925), but I regret that I cannot adopt all her proposals. Since all the nectophores of polygastric stages of Calycophorae appear to be homologous structures, it is as well to use the same terms throughout for comparable parts. I therefore retain the term " dorsal " for the abaxial, and " ventral " for the axial side of the mouth of the nectosac of all such nectophores. Moser, who regards the inferior or posterior nectophore as a sterile gonophore and not a homologue of the anterior one, calls the abaxial side of one nectophore of a Prayid or Diphyid " dorsal " and that of the others " ventral." On the other hand, I agree with Gegenbaur, Huxley, Chun, and Bigelow in regarding the nectophores as homologous structures.

About the use of the terms " right " and " left " there is a difficulty. Having adopted the convention of calling the " abaxial " side of a nectophore " dorsal," and knowing that its apex is directed towards the aboral end of the whole organism, there should be no ambiguity about " right " and " left." Unfortunately the convention has been adopted by both Bigelow and Moser of viewing a nectophore from the dorsal side with aboral end uppermost, and applying the term " right " to the side opposite the right hand of the observer. Since Moser applies the term " dorsal " to that side of the posterior nectophore which Bigelow calls " ventral," there is no uniformity even in present usage. In the present report the term " dorsal " is used for the " abaxial " side of all nectophores, and " right " and " left " are employed in the morphological sense, assuming the apical end of a nectophore to be the aboral one. Thus if a Diphyid, with somatocyst uppermost, is momentarily swimming in a horizontal position towards the north, the eastern side of its anterior nectophore and the western side of its posterior nectophore is the right side ; for it is swimming with its aboral end foremost, and with the " dorsal " side of the posterior and " ventral " side of the anterior nectophore uppermost.

In describing eudoxids I have been consistent in the use of the same terms for homologous structures. Moser (1925) uses the terms " headpiece," " neck-shield," and " suture "* (Kopfstück, Nackenschild, Naht), which supply good points of reference. The surface opposite the " suture " she refers to as dorsal, and I have followed her in this throughout ; so that it is easy to understand what she means by the statement that the edge of the left side of the neck-shield is a continuation of the left sutural ridge.† But in her description of *D. bojani* the dorsal side of the bract becomes the " Oberfläche " and the sutural surface the " Innensiete." In this I have not followed her. In *D. mitra* and *D. spiralis* the left side of the bract is termed by Moser the " right ventral " and the sutural surface the " left ventral," whilst the left edge of the sutural surface becomes the " ventral ridge." Here again I have not followed her practice, preferring to use throughout only one term for each structure. I adopt the convention of calling the abaxial side of the gonophore the " dorsal " one.

---

* The " suture " is the surface of the bract which lies next to the stem or axis. There is nothing in the nature of a suture about it in its development.

† I say that the right side is a continuation of the right ridge because the apex of the bract is the aboral end.

The term "basal" is applied to the oral, and "apical" to the aboral end of a nectophore or gonophore.

It had been hoped when the collection was first taken in hand that the tow-nettings would include material of all stages of development of such common forms as *Diphyes chamissonis*, but although prolonged and careful search has been made, only four diphyid larvae about three-quarters of a millimetre in length have come to light so far. They are referred to under *D. chamissonis*.

Most of the plankton hauls were made inside the edge of the Great Barrier Reef. Six stations were taken in the deep oceanic water outside the Barrier edge, and a few in intermediate positions.

The number of published observations on the behaviour of living Siphonophores is very small, but a study of the available accounts, such as those of Vogt (1854), and more recently of Berrill (1930), shows of what great importance in the animals' economy is the fishing-line apparatus of the tentacles. Evolutionary progress appears to have been in the direction of forming cover for this and other appendages when not in use, and providing for increased rapidity of retreat from enemies. I regret to have had little opportunity for studying living Siphonophores. A few observations which I have been able to make are mentioned later.

Species of six families belonging to two suborders were taken. The suborders Rhizophysaliae and Chondrophorae are not represented at all.

2. LIST OF SPECIES.

PHYSOPHORAE.

Agalmidae.

1. *Agalma okenii*, Eschscholtz.
2. *A. elegans* (Sars).
3. *Agalma*, sp. indet.
4. *Stephanomia bijuga* (Delle Chiaje).
5. *Cordagalma cordiformis*, gen. et sp. nov.

Forskaliidae.

6. *Forskalia*, sp.

CALYCOPHORAE.

Prayidae.

7. *Rosacea ? plicata*, Quoy and Gaimard.
8. *Amphicaryon acaule*, Chun.

Hippopodiidae.

9. *Hippopodius hippopus* (Forskål).

Abylidae.

10. *Abyla haeckeli*, Lens and Van Riemsdijk.
11. *Abylopsis tetragona* (Otto).
12. *Enneagonum hyalinum*, Quoy and Gaimard.
13. *Abylopsis eschscholtzii* (Huxley).
14. *Bassia bassensis* (Quoy and Gaimard).

Diphyidae.

15. *Sulculeolaria quadrivalvis* (Blainville).
16. *S. monoica* (Chun).
17. *Galetta chuni* (Lens and Van Riemsdijk).
18. *G. turgida* (Gegenbaur).
19. *Diphyes dispar*, Chamisso and Eysenhardt.
20. *D. bojani* (Chun).
21. *D. chamissonis*, Huxley.
22. *Chelophyes appendiculata* (Eschscholtz).
23. *Eudoxia russelli*, sp. nov.
24. *C. contorta* (Lens and Van Riemsdijk).
25. *Eudoxoides mitra* (Huxley).
26. *E. spiralis* (Bigelow).
27. *Dimophyes arctica* (Chun).
28. *Lensia subtiloides* (Lens and Van Riemsdijk).
29. *L. subtilis* (Chun).
30. *L. campanella* (Moser).
31. *L. fowleri* (Bigelow).
32. *Lensia*, spp. indet.

3. DESCRIPTION OF SPECIES.

Physophorae.

Agalmidae.

Two " Athorybia " larvae of Agalmids have been picked out of the catches, a larger one 2·5 mm. in length, with eight bracts, taken in an open vertical haul of the Nansen net from 180 m. outside Trinity Opening on 20th October; and a smaller one 1·1 mm. in length, with four bracts, taken nearby on the same day in a similar vertical haul from 250 m. to the surface. As the larvae are not in very good condition no attempt will be made to describe them. The bracts have three longitudinal ridges on the upper side, a small terminal saccule and a deep excavation on the lower or inner side. The angle between their two sides forms what might be described as another ridge on either hand.

Five species of Agalmids have fully grown representatives in the collection. Of three species, including *A. elegans*, there are only a few small loose nectophores. Two of them cannot at the moment be identified with any known species, but their form and the run of their lateral canals are in each case quite characteristic. One is regarded as the genotype of a new genus *Cordagalma*.

Agalma, Eschscholtz, 1825.

(?) *Cuneolaria*, Eysenhardt, 1821 [in Chamisso and Eysenhardt, 1821, p. 369].

Bigelow (1911*b*), the last reviser of the genus, recognized four species of *Agalma*—*A. okenii*, Eschscholtz, *A. elegans*, Sars, *A. clausi*, Bedot, and *A. haeckeli*, Bigelow (=*A. eschscholtzi*, Haeckel). It may be possible to recognize and distinguish the last two in the field, but at any rate Bedot's figures do not appear to me to be sufficiently good to make

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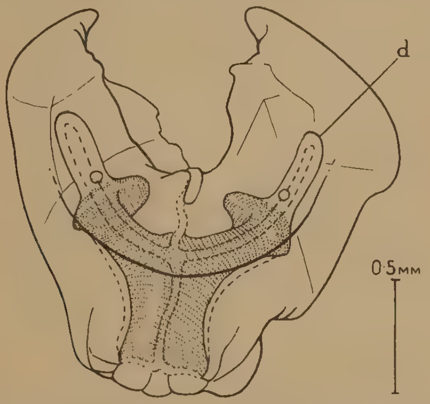
possible the identification of detached nectophores. If Haeckel's figures of the nectophore of *A. haeckeli* be correct, it can be at once distinguished by the direct, unlooped, lateral radial canals, and the shape of the bracts is diagnostic.

Bigelow (1911*b*), who has had the opportunity to study a large series of living specimens of *Agalma okenii,* states that " in very small specimens " the bracts associated with the oldest siphon are unlike those found on older specimens, in having only two facets. Some young specimens brought back by the expedition bear young bracts showing the transition between the two- and the four-facet stages.

Agalma okenii, Eschscholtz, 1825.

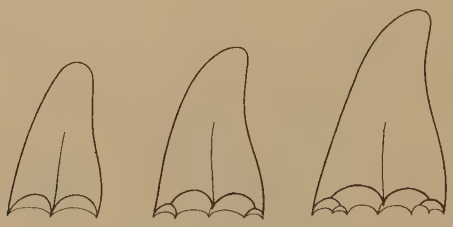
Five young specimens measuring from 3 mm. to 15 mm. in length were taken in the tow-nets. Medium-sized nectophores have on each side of the mouth an oblique dorso-lateral facet, divided from a triangular facet by a ridge opposite the end of the horn of the nectosac. In older nectophores this triangular facet becomes divided into two by a second ridge, but it is clearly absent in young nectophores. In fact, the young nectophores of this species closely resemble the adult nectophores of *A. elegans*, and may be said to pass through an "*elegans*" stage. The ends of the horns of the nectosac are broadened obliquely—a feature not shown by Bigelow (1911*b*) in pl. 17, fig. 12. Viewed from the ventral surface—that is, the side turned towards the stem and the posterior end of the specimen—the course of the lateral canal is as follows: Starting from the pedicular canal, it runs outwards along the aboral and inner margin of the arm of the nectosac, to pass away obliquely over the middle of its broadened end. It then makes a semicircular sweep on the lateral wall of the nectosac-arm or horn towards its dorsal edge, loops down to its ventral edge at a point about midway between mouth and tip of arm, runs back obliquely on to the ventral side of the nectosac, where it appears as a loop, and finally runs up, obliquely, to the dorso-lateral side of the mouth of the nectosac.



Text-fig. 1.—*Agalma okenii*, Eschscholtz. × 34. Young nectophore showing the diverticulum, *d*, of the lateral radial canal ascending over the lateral horn of the nectosac.

In the smaller nectophores the loop made by the lateral radial canal on the ventral side is relatively much smaller, and the transverse ridge is often absent from the oblique dorso-lateral facet. In some of the smaller, not fully developed nectophores there is on each side a large upstanding diverticulum of the lateral radial canal as much as 0·22 mm. in length and 0·15 mm. in diameter, at the point where it crosses the apex of the nectosac arm. These diverticula become absorbed later on, but often leave vestiges. Distally to this diverticulum the canal is not looped in the earliest phase of a growing nectophore. One of the distinguishing features of this species is the faceted bract.

The bracts taken with the youngest specimen are of two kinds, some shorter, 3·3 mm. in both length and breadth, and two longer, up to 6·6 mm. in length. Each kind is enantiomorphic. In both there are two asymmetrical main facets, but in the smaller ones there is a small subsidiary distal facet on the edge, which cuts off the distal end of one of the lateral ridges. In the largest bract from Station 49 there are two of these subsidiary facets. I have observed two similar facets, subsidiary to the usual four, as a constant character in *A. okenii*, though I have seen no mention of them in published accounts. Bigelow (1911*b*) figures one such facet with its two cusps on the extreme edge of the bract, just above the " 10 " of fig. 10, pl. 17, and the cusps of its fellow on the other side, but makes no mention of them in the text. There is one attached immature bract of the shorter type about 0·75 mm. in length which has rudiments of a subsidiary facet on each side.



TEXT-FIG. 2.—*Agalma okenii*, Eschscholtz. Diagram of three successive growth-stages of a bract to show the origin of secondary and tertiary facets on the distal edge.

In the accompanying text-figure can be traced the development of the mature bracts with three series of facets. In the first stage there is a single pair. The second and third pairs arise as flattenings of the outer and intermediate cusps.

Agalma elegans (Sars, 1846).

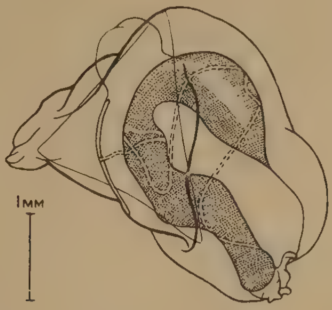
Four small nectophores 2 mm. in width from a vertical haul at St. 28, outside Trinity Opening, 23rd November, 1928. In the shape of the nectosac and run of the radial canals they agree with Bigelow's (1911*b*) pl. 19, figs. 2–3, which are characteristic of the species.

Agalma, sp. indet.

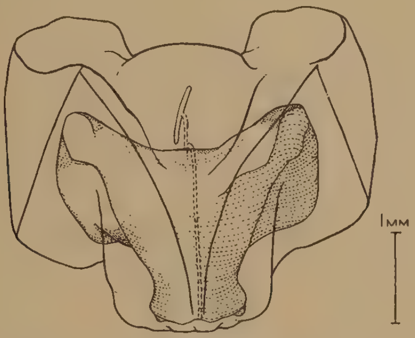
Six detached nectophores, the largest measuring 4·8 mm. in width, 3·5 mm. from the oral to aboral side, and 2·9 mm. dorso-ventrally; taken in a vertical haul of the stramin net from 400 m. to the surface outside Papuan Pass on 18th March.

The shape of the nectosac and run of the radial canals are the same in all six nectophores, and differ distinctly from the arrangement found in *A. okenii*, *A. elegans*, *A. haeckeli* and *A. clausi*.

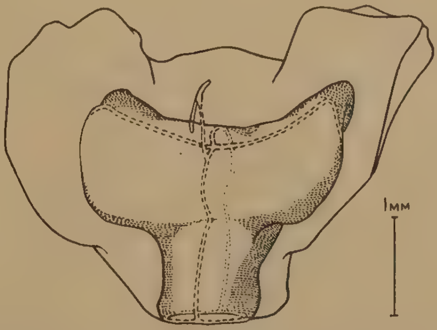
The lateral wedges of the nectophores, which probably belong to a young specimen, are not so drawn out and flattened as are those of other known species at an equivalent age, but nevertheless have the same arrangement of lateral facets. The nectosac is relatively deeper dorso-ventrally, occupying more of the volume of the nectophore. The pedicel is not nearly so long as in *A. okenii*. This character is best appreciated when a lateral view is taken. The ventral wall of the nectosac is relatively deep dorso-ventrally, and forms a gentle concave curve from side to side. There is on each side a deep oblique



TEXT-FIG. 3.—*Agalma*, sp. indet. × 13. Lateral view of a nectophore to show the region of attachment, and the course of the lateral canal.



TEXT-FIG. 4.—*Agalma*, sp. indet. × 13·5. Dorsal view of a nectophore to show the shape of the nectosac.



TEXT-FIG. 5.—*Agalma*, sp. indet. × 15. Ventral view of a nectophore to show the pedicular and radial canals.

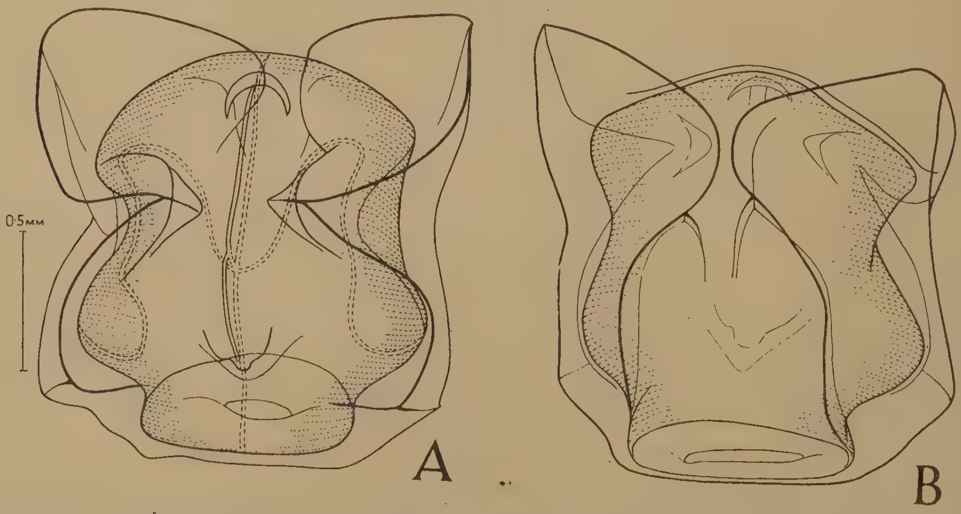
dorso-ventral expansion or horn of the nectosac. The transverse ventral wall does not curve away in a broad sweep towards the lateral side of the horn at this point as in *A. okenii*. Instead there is a distinct ridge between the ventral and lateral walls of the nectosac.

The course of the lateral radial canals is characteristic. From their junction with the pedicular canal they run out horizontally to the middle of the ridge on the lateral horns, and after a slight upward bend turn down and run to its ventral end. Each lateral radial canal then curves up to form a large vertical loop that covers the dorso-lateral surface of the nectosac. The descending limb of the loop passes just over on to the ventral surface before running up to the side of the mouth, but does not form what might be described as a ventral loop.

A series of special terms would be needed for an adequate and concise description of the various surfaces and angles of the nectophore and nectosac, and of the loops of the radial canals. At the present moment this extended description, illustrated by text-figures, will suffice to indicate the points in which these nectophores differ from those of previously described species. The nectophores of the various species seem to be highly characteristic, and a closer study of their morphology would facilitate the identification of material.

Stephanomia bijuga (Delle Chiaje, 1842).

This species occurred sparingly at both inside and outside stations, as well as intermediately throughout the year, although there were no records of it for the months February, May, August and September.



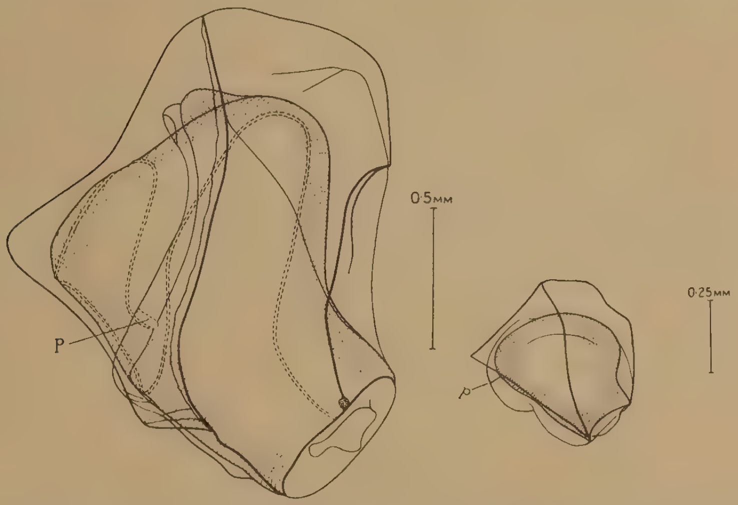
TEXT-FIG. 6.—*Stephanomia bijuga* (Delle Chiaje). × 42. A, Ventral view of a young nectophore to show the region of attachment, and the pedicular and radial canals; B, dorsal view of the same to show the ridges.

Only five complete specimens were taken, varying in length from 2 mm. (an extended specimen) to 5 mm. (a contracted one). The greatest number of detached nectophores taken in one haul was twelve. The pneumatophores varied in size from 0·5 mm. to 3 mm.

in length and 0·3 mm. to 0·71 mm. in diameter. An extended specimen, 3·6 mm. in length, had a pneumatophore measuring 0·7 mm. in length and 0·3 mm. in diameter, and bore five nectophores (seven detached ones were present also) and four siphons.

The nectophores correspond with those of a specimen taken at Valentia Harbour, Ireland, by Miss Delap, and with figures given by Claus (1878) for *Halistemma tergestinum*, but differ from those figured by Bigelow (1911*b*), pl. 19, figs. 6 and 7, in that the junction of the radial canals with the pedicular is on a line drawn between the mouth and the tip of the lateral horn, so that the lateral radial canals make an ascending sweep on the inner side of the lateral horn of the nectosac. Bigelow's figure appears to show the origin of the pedicular canal at a point corresponding with the upper end of the semilunar muscular lamella.

The tentilla of the specimen from St. 37 are well preserved and distinctly unicornuate.



TEXT-FIG. 7.—*Stephanomia bijuga* (Delle Chiaje). × 42. A, Lateral view of a young nectophore to show the course of one of the lateral radial canals; B, the same view of a younger nectophore, to show the position of the pedicular canal, *p*.

Cordagalma, gen. nov.

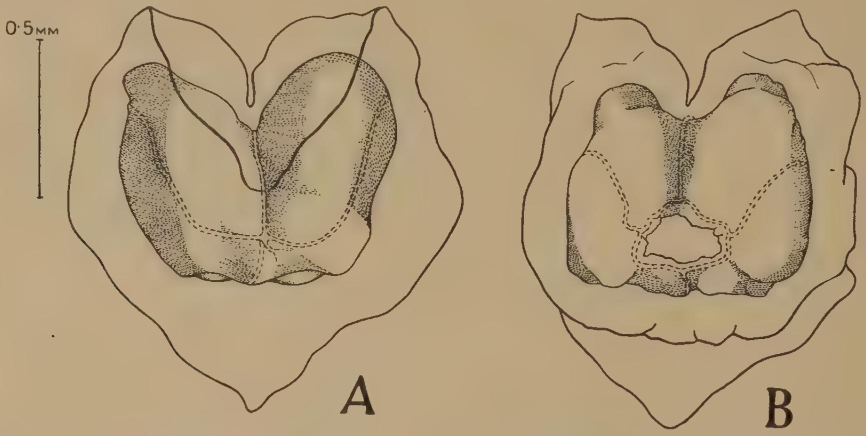
GENOTYPE.—*Cordagalma cordiformis*, sp. nov.

This name is proposed for a genotype whose detached nectophores differ from those of any existing genera in being attached by their bases to the muscular lamellae. The upper limit of attachment does not reach the level of the upper, median wall of the nectosac, and the lower extends well down on to a pointed basal process of the nectophore. The lateral radial canals are comparatively simple and unlooped.

Cordagalma cordiformis, sp. nov.

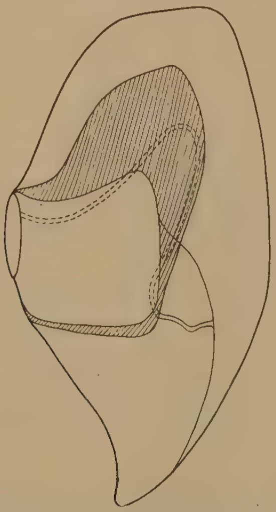
Six small nectophores, the largest measuring 2·5 mm. in length, 2·2 mm. in breadth, and 1·4 mm. in thickness from inner or ventral side to oral side, were taken in a vertical haul of the coarse silk net at St. 19 on 20th October.

The nectophores are not in a good state of preservation, but they agree with one another in several characteristics. Viewed from the oral or outer side they are shaped like the conventional heart with a point below and two rounded lobes above.



Text-fig. 8.—*Cordagalma cordiformis*, sp. n. ×47. A, Ventral view of a nectophore to show the radial canals ; B, dorsal view of the same.

The semilunar process is attached unusually low down the nectophore, the upper end not reaching the level of the upper, median wall of the nectosac, and the lower extending well down on to the pointed process below (Text-fig. 9). This at once distinguishes the nectophores from those of known species of *Agalma*, *Lynchnagalma*, *Anthemodes*, *Stephanomia*, *Nectalia*, *Physophora* and *Pyrostephos*. *Erenna* is not sufficiently well known for a description of its nectophore to be given.



Text-fig. 9.—*Cordagalma cordiformis*, sp. n. Diagrammatic lateral view, showing one of the simple lateral radial canals. The horn of the nectosac is cross-hatched.

The junction of the pedicular and radial canals is nearly on a level with the base of the nectosac. The two lateral radial canals sweep upwards to form a semicircle on the inner face of the nectosac. Each passes round the lateral horn some distance below its blind upper end and sweeps down without any secondary loops to the side of the mouth of the nectosac. The lateral horns themselves extend chiefly upwards, and are divided from one another by a sharp cleft. They extend only slightly round the stem. The nectophores indeed appear not to dovetail into one another as is usually the case, since there are no lateral triangular processes or wedges.

The nectophores of this species should be recognized again with ease; and it will be convenient for the present to give the species to which they belong the name *cordiformis*, and to make the species the genotype of the new genus *Cordagalma*. The six nectophores may be considered as parts of the holotype of the species.

I have since taken many small nectophores that correspond exactly with these off Kingstown, St. Vincent, B.W.I., at the surface at night in the month of February. I am still without a clue as to the species to which they belong, but they can be so easily recognized that they may be given a provisional name.

Foskaliidae.

Forskalia, sp.

Seven small loose nectophores 3 mm. in length, and a single bract measuring 4 mm. in length and 1 mm. in breadth, were taken in a vertical haul from 170 metres to surface at outside St. 50 on 18th March, 1929.

This was the only occurrence of any species of *Forskalia*. The condition of the specimens does not warrant a detailed description.

CALYCOPHORAE, Leuckart, 1854.

Although it is not proposed in this place to make a detailed criticism of the opinions on phylogeny expressed by Moser (1925), it is felt to be desirable at once to dissent from her conclusion that Calycophorae were the ancestors of the Physophorae. Moser considers the pneumatophores of the Physophorae to be altered swimming-bells of Calycophoran ancestors, but I consider them to be derived from primitive apical organs. The larval bells of the Calycophorae I regard as precociously developed homologues of the swimming-bells of the Physophorae.

Of the four families recognized by Bigelow (1911*b*), two, Prayidae, Kölliker, and Hippopodiidae, Kölliker, may be accepted as natural groups, but have only one and two representatives respectively in the collection. The third, Sphaeronectidae, Bigelow (=Monophyidae, Chun), does not appear to be a natural group, whilst the two sub-families of the fourth, Diphyidae, I regard as separate families. The character on which alone the family Sphaeronectidae is founded is the presence of a single nectophore. There is evidence that such a condition has been brought about along several converging lines of evolution. The phenomenon, which may be referred to as monophyism, appears not only amongst the Diphyidae, but in the Abylidae as well. It will be seen, for instance, that *Enneagonum hyalinum* (=*Cuboides vitreus*) is an Abylopsid that has lost its second nectophore. It would only defeat the ends of a scheme of natural classification to name as a special group a heterogeneous collection of " Diphyids " (Dimophyidae, Moser, 1925) that included amongst other forms a species of *Diphyes* with a reduced posterior nectophore (*Dimophyes arctica*), and an Abylopsid with none (*Enneagonum hyalinum*). As to Bigelow's two reasons for accepting Chun's group Monophyidae, there seem to be no grounds for assuming either that *Muggiaea*- and *Cuboides*-like forms gave rise to Diphyids and Abylids respectively, or that monophyism was ancestral.

I reject Chun's group because of the fact that after careful consideration of the sum of the characters of each Calycophoran species we can arrange them in natural groups or genera that contain species not only of one sort—polyphyid, diphyid or monophyid—but also that form any of the four combinations of these three kinds. It may be argued, therefore, that monophyism is not a character upon which alone to base conclusions as to natural relationship. For this reason I do not recognize as a single natural group an association of all the monophyid species. *Monophyes* and *Sphaeronectes* themselves may be neotenous forms retaining larval features rather than modern survivors of primitive adults, and for them the name " Sphaeronectidae " must be retained. The affinities of *Muggiaea* are with Diphyids; and *Nectopyramis* is a Prayid.

The collection contains only one species included in the Sphaeronectidae of Bigelow, namely, *Enneagonum hyalinum*, and this is dealt with amongst the species of *Abylopsis*.

The main difference between Diphyidae and Abylidae is that while the Diphyids would appear, from the comparative sizes of the two nectosacs, to use the anterior one as their chief propulsive organ, the Abylids, as a rule, use the posterior nectosac almost exclusively. In fact I have observed that *Abylopsis tetragona* only uses the anterior sac intermittently, and then possibly for changing direction. The difference might be more accurately expressed by saying that whereas the Abylids have, as a rule, reduced their first formed bell and relied on the propulsive effort of the second, the Diphyids have entirely discarded it, but made use of a smaller third one. Two of the Abylopsids, however, appear to have struck out in a direction rather different from that taken by other Abylids. *A. eschscholtzii* has a reduced posterior nectophore, and *Enneagonum* or *Cuboides* has entirely lost it. Nevertheless, certain members of both families, Diphyids and Abylids, starting presumably from a stage of evolution comparable with that of the Prayids, have after following these diverging paths reached the same point and have become " monophyids "; but *D. spiralis* has become a small, stream-lined, active darter, whilst the larger, unwieldy *Enneagonum hyalinum* is probably not able to do much more than counteract the force of gravity. It would be most interesting to know how this curious species actually does behave.* We are tempted, then, as pure speculation, to suppose that the ancestral Physophore, with its numerous rapidly pulsating bells driving the colony along in a direction at right angles to the axis, was succeeded by forms like Prayids with a reduced number of bells which probably progressed in line with the axis; and that in turn arose forms like the Galeolariids and Diphyids with two bells staggered one behind the other, whose propulsive efforts reinforced one another, and the Diphyids, able to draw the stem under cover and increase their speed of escape from enemies. The posterior bell of some was at last found to be a drag and discarded. Meanwhile the ancestral Abylids found it a good plan to drive with the second bell and change direction with the first. The acquisition of this new function of the first bell led to its development on novel lines again in the Abylopsids, and culminated in its exclusive use in such a form as *Cuboides*.

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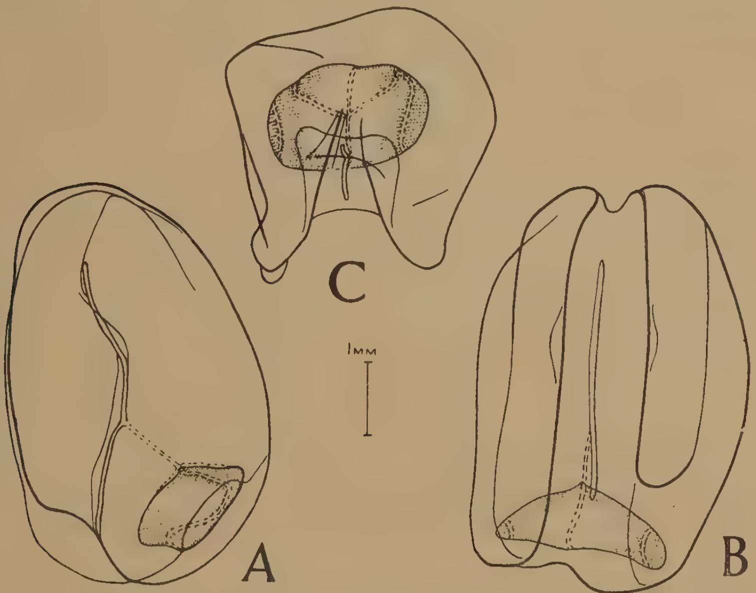
* Bigelow (1911*b*) said that throughout the 5-month cruise of the " Albatross " in the Eastern Tropical Pacific he had the opportunity of studying the siphonophores—one of the most extensive series ever collected—alive, but as far as I know he published nothing about their behaviour.

Prayidae.

There are ten recognizable and one doubtful species of Prayids which are to be assigned to six or seven genera. The only one that is at all common has for the last eighty-eight years been known as *Praya cymbiformis*, Delle Chiaje. Unfortunately strict adhesion to the rules of nomenclature results in the application of the name *Praya* (originally spelt "*Praia*") to the form for which Bigelow (1911) erected a new genus, *Nectodroma*.* Two other names are avilable for the genus of which *cymbiformis* is the genotype, namely, *Eudoxella*, Haeckel, 1888*a*, and *Huxleya*, Gravier, 1899. But I am inclined to believe it is congeneric with *Rosacea*, in which case that name would have priority.

Rosacea ? plicata, Quoy and Gaimard, 1827.

A single nectophore, probably the elder one, 5·6 mm. in length, taken in an oblique haul at St. 26 in Trinity Opening on 19th November, 1928.



TEXT-FIG. 10.—*Rosacea ? plicata*, Quoy and Gaimard. × 11. A, Lateral view of the nectophore to show the course of one of the radial canals ; B, ventral view of same ; C, apical view of same.

The specimen corresponds in general with a nectophore of *Praya diphyes*, Blainville, figured by Vogt (1854). In the absence of any very critical published morphological details of this species I make this tentative identification following Bigelow's synonymy. The left hydroecial fold is shorter than the other, whether as the result of an accident it is not possible to say. The nectosac is somewhat deformed—probably a post-mortem change—and it is not easy to see exactly how the curved lateral radial canals run.

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* *Praia* was clearly applied by Blainville to a form with laterally branched somatocyst. He said " . . ." j'ai pu très-bien apercevoir un vaisseau médian donnant deux branches latérales, avec des ramifications bien similaires." The application of the name "*Praya*" has been discussed by Bigelow (1931) since this was written.

Amphicaryon acaule, Chun, 1888.

A single complete specimen was taken at St. 50, outside Papuan Pass, on 18th March, in a vertical open net fished from 170 m. to surface. The smaller, shield-shaped nectophore, with its vestigial closed nectosac, measures 2·47 mm. in length, and the larger one 3·14 mm. The state of preservation is not very good, but is sufficient to enable me to identify it without doubt.

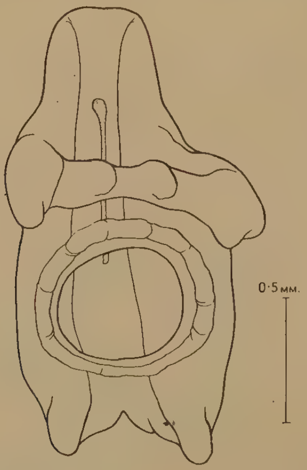
Bigelow held the vestigial nectophore to be the primary one, chiefly because in a specimen 3 mm. long this nectophore was longer than the other. Moser, however, described a still smaller specimen, 2·5 mm. in length, in which the lengths of the two nectophores were equal. I am inclined to agree with Moser that the vestigial nectophore is probably the secondary one.

The known distribution is as follows: W. Indies (Bigelow); Chesapeake Bay (Bigelow); Canaries (Chun), Tropical and Subtropical Atlantic (Moser); Chagos, Farquhar and Amirante Is., Indian Ocean (Browne); Eastern Tropical Pacific (Bigelow). It appears to be a midwater species, and thus to have escaped much attention.

Hippopodiidae.

(?) *Hippopodius hippopus* (Forskål, 1776).

The material consists of a single nectophore 4 mm. in length, a single larva or primary bell, 1·5 mm. long, and a female gonophore 1·9 mm. long. The nectophore is rounded, but not well enough preserved to show the dorsal prominences. The specimens were taken in a vertical haul from 400 m. to the surface outside Papuan Pass on 18th March, 1929.



Text-fig. 11.—(?) *Hippopodius hippopus*. × 37. Dorsal view of a young nectophore.

Two small nectophores, 1·9 mm. and 3·6 mm. in length, from St. 50 outside Papuan Pass, 18th March, probably belong to this species. I have examined an even smaller nectophore removed from an undoubted specimen of *H. hippopus* taken in the Tropical Atlantic, and it agrees closely in shape with the one figured (Text-fig. 11); but the next older nectophore of that same Atlantic specimen, although it is smaller than the second Barrier Reef one, has already assumed the characteristic shape found in older nectophores of *H. hippopus*.

These young Barrier Reef nectophores resemble Bigelow's figure (1918, pl. 4, figs. 2, 3) of a nectophore of *Vogtia glabra* 7 mm. long in their elongate outline and pointed apex, but have four dorsal prominences as in *H. hippopus* instead of two as in *V. glabra*. I have not seen any nectophores of *V. glabra* smaller than one 4 mm. in length, and that is already beginning to assume its definitive shape, and has only two prominences.

Abylidae.

(Abylinae, L. Agassiz, 1862.)

It might be argued that *Bassia* and *Abylopsis* are more primitive than *Abyla* and *Diphyabyla*. For in the posteror nectophore of both *Bassia* and *Abylopsis* there are lateral ridges, and in that of *Abylopsis* also a complete dorsal ridge, while the right and left hydroecial folds stretch across the hydroecium as in the Diphyidae. In *Abyla* and *Diphyabyla*, on the other hand, there is a general reduction of these ridges, and the hydroecial folds may be hypertrophied into very large parallel plates which no longer roof over the hydroecium. But *Bassia* and *Abylopsis* differ from all other Diphyids in the peculiar way in which the two nectophores are orientated and articulate with one another. They have, too, a peculiar arrangement of ridges of the anterior nectophores, which appears to be connected with the stream-lining of this new arrangement. It can therefore be argued, I think, that these genera are more specialized than *Abyla* and *Diphyabyla*. One way of reconciling these views is to suppose that in *Bassia* and *Abylopsis* the chief evolutionary changes have taken place in the anterior nectophore and its articulation with the posterior, while in *Abyla* and *Diphyabyla* it is in the posterior nectophore that these have occurred.

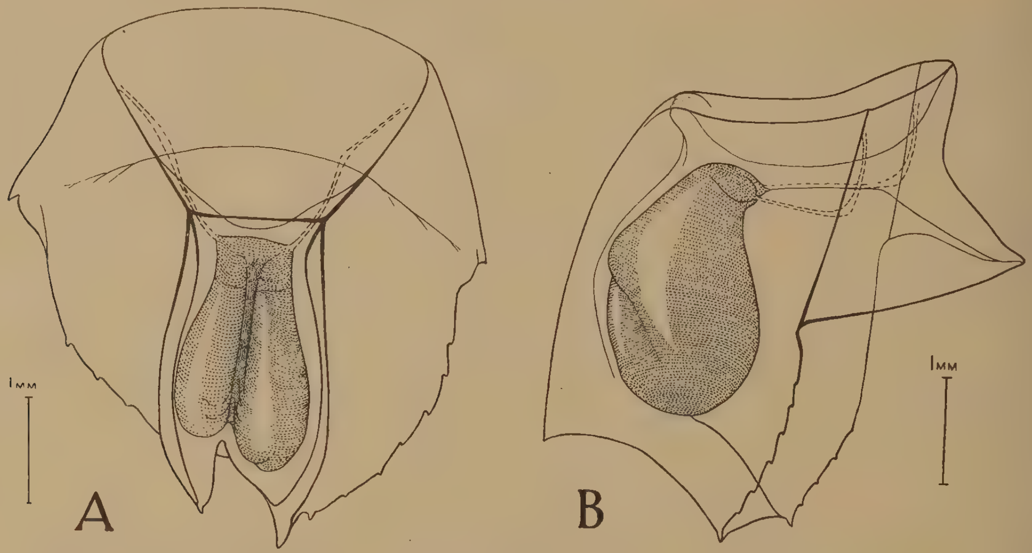
Indeed I have noticed, while observing living specimens of *Abylopsis tetragona* in the Gulf of Algeciras, that the two nectophores appear to function independently. Propulsion is effected by the rather slow rhythmic contraction of the posterior nectophore, while the anterior one appears to contract spasmodically, but more rapidly.

Abyla haeckeli, Lens and Van Riemsdijk, 1908.

One anterior nectophore, the identification of which rests upon the presence of a transverse ridge dividing the ventral facet into two parts, was taken at the weekly station 3 miles east of Low Isles on 2nd October. With it were taken two Abylid posterior nectophores, neither of which is in a good state of preservation. The characters of both were elucidated by manipulation with needles.

One of these posterior nectophores, which is 10 mm. in length, I believe to belong to this species. Its nectosac is relatively short in comparison with the pedicel. There is a large median dorsal tooth and corresponding ridge, a right lateral tooth and ridge, and a left lateral tooth without ridge. The left hydroecial ridge is not toothed, but appears to have a thickened edge ("Polster") in the middle region, where both ridges are most prominent. The right hydroecial ridge has a proximal toothed flap and a distal toothed edge. The five teeth in this basal region decrease in size from the middle region towards the velar end, the last being just above the level of the velum. There is no thickened mouth-plate with oblique basal facet, such as is found in *A. trigona*. Instead the plate connecting the two ventral teeth is quite thin.

I have assigned tentatively to this species two Abylid eudoxids that resemble the type (" *Amphiroa* ") usually assigned to *A. trigona*. In the past, Abyline eudoxids have been referred, if of the " *Ceratocymba* " type, either to *Ceratocymba sagittata* or *C. asymmetrica* ; if of the "*Amphiroa*" type, to *Abyla trigona* ; and if of the " *Cymba* " type, to *A. leuckartii*. But the eudoxids of *Abyla dentata* and *Diphyabyla hubrechti* are of the " *Ceratocymba* " type too. It is clear that much critical work remains to be done on the Abylid eudoxids. For instance, I am unable to find sufficiently critical descriptions and figures of eudoxids definitely known to belong to *A. trigona*.



Text-fig. 12.—*Abyla haeckeli*, Lens and van Riemsdijk. × 16. The bract of a eudoxid. A, dorsal view, showing artefact ; B, lateral view.

We know that *haeckeli* occurs in the Barrier Reef region. Now since its eudoxid is likely to resemble that of *A. trigona* because of the similarity of their anterior nectophores, and since eudoxids differing slightly from those found in association with *trigona* have been taken there, it is probable that these eudoxids can be assigned to *haeckeli*.*

The outline of the bract, when viewed from the dorsal side, somewhat resembles that of *Ceratocymba*, the edges of the lateral walls of the hydroecium being bowed out and toothed. The ventral facet is convex. The arrangement of teeth on the hydroecial flap or " Leiste " of the gonophore differs from that figured by Lens and Van Riemsdijk for *A. trigona*. Bigelow, it will be remembered, maintains that the bract of the eudoxid of *haeckeli* has a concave ventral facet and an asymmetrical greatly developed " left " ventro-basal angle as in *Amphiroa dispar*, Bedot (1896).

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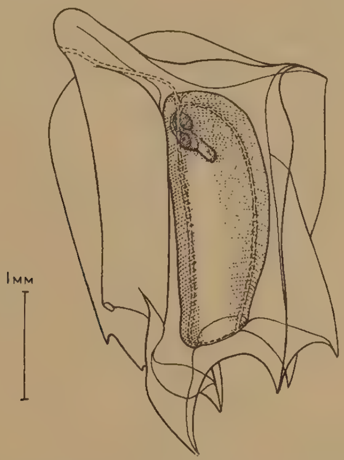
* Since this was written, anterior nectophores of *A. haeckeli* and "*Amphiroa*" eudoxids have been found in association in hauls made in the New Zealand region by the British Antarctic (" Terra Nova ") Expedition, 1910–13.

One of these eudoxids, with gonophore attached and a single gonocalyx 6 mm. in length, was taken at an intermediate station inside Papuan Pass on 17th March. It is crushed, but the general shape of the phyllocyst with its large ovoid descending branch can be plainly seen. The loose gonocalyx (Text-fig. 13) has a small vermiform manubrium. There is a well-developed right ventral (hydroecial) ridge, toothed on its basal margin. A small delicate left hydroecial flap (Leiste) with a pronounced tooth is visible, but is crumpled slightly. The median dorsal and other four teeth are in a good state of preservation. Viewed from the side, the mouth-plate can be seen to have a flattened, oblique, basal facet, such as is found in the posterior nectophore of this and other species of *Abyla*. The attached gonophore is the mirror image of the loose one. Its manubrium is not visible.

The second, consisting of a well-preserved but slightly damaged bract and a well-preserved loose female gonophore, was taken the next day at St. 50, outside Papuan Pass.



TEXT-FIG. 13.—*Abyla haeckeli*, Lens and Van Riemsdijk. × 16. Lateral view of a gonophore, showing the incomplete dorsal ridge and tooth.

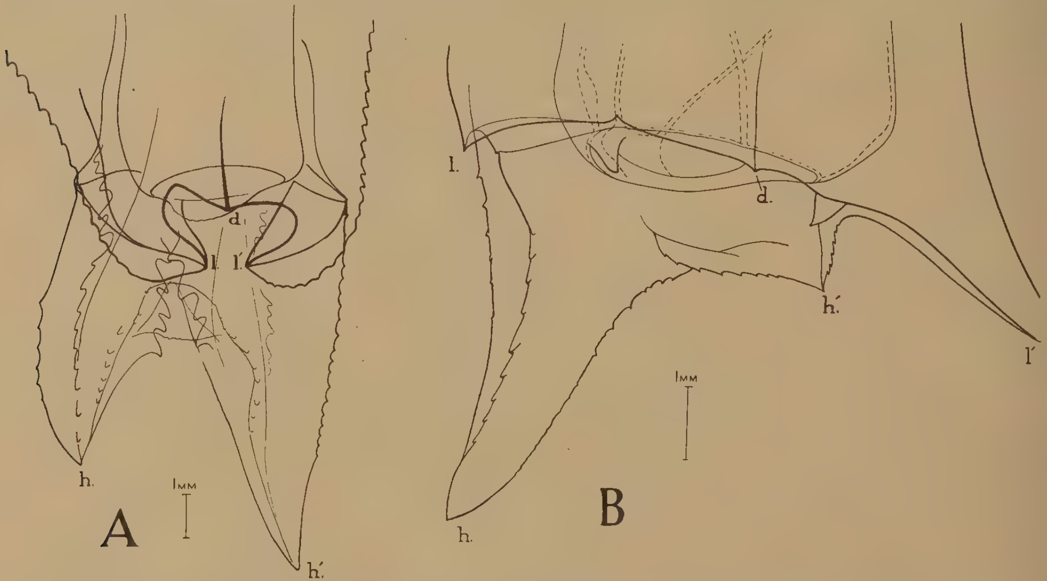
The flap or "Leiste" of the gonophore has one large basal recurved hook-like tooth, and a smaller vestigial one close to the ventral wall of the hydroecium. The base of the left ventral (hydroecial) ridge bears two strong teeth. The dorsal median ridge, which extends for only half the length of the dorsal facet, lies asymmetrically, nearer to the right dorsal ridge. The radial canals, which appear to be reticulated, do not run in the usual dorsal, ventral and lateral positions. The dorsal canal runs under the right lateral ridge, though it meets the circular canal under the median dorsal tooth. The right lateral runs inside the right ventral ridge, but the left lateral canal lies inside the left lateral ridge in its normal position, and the ventral canal lies inside the remaining left ventral ridge. The manubrium bears two ova.

Abylopsis tetragona (Otto, 1823).

Specimens of the polygastric and eudoxid stages were taken in ones and twos in all months of the year except December, April, May and July at the weekly inside, three outside and one intermediate stations. The estimated total numbers taken are 15 polygastric specimens and 18 eudoxids—a remarkably small number for a year's tow-netting work.

Five specimens of the two stages were taken at the vertical distribution stations 16 and 62 in the upper layers (3–8 m.).

This species links the genera *Abyla* and *Abylopsis* together. The two peculiar oblique folds at the base of the mouth-plate (Text-fig. 14) can be homologized with the margins of a flattened elliptical area of the same structure in *Abyla dentata*, Bigelow (=*A. quadrata*, Moser) (Text-fig. 15). This rather trivial feature may be of some importance in considering questions of phylogeny, as it appears to be a vestigial character. The significance of the peculiar arrangement of radial canals is that it is a device for making a new arrangement of five radial canals out of four, the new one lying under the right ventral ridge. The proximal part of this fifth canal is formed by the deflected and altered left lateral. There is then a gap, and the distal part is a new oblique offshoot from the ventral "Gefässplatte." In *A. dentata* this left ventral ridge is associated with a canal by a change in the course of the median dorsal, over which there is no longer a complete ridge, and the left lateral, the first taking the place of the second, which in its turn comes to lie inside the left ventral. It is this left ventral ridge that becomes displaced and finally reduced in *Abyla*, and the changes in the arrangement of the radial canals in Abylids appear to be correlated with this.

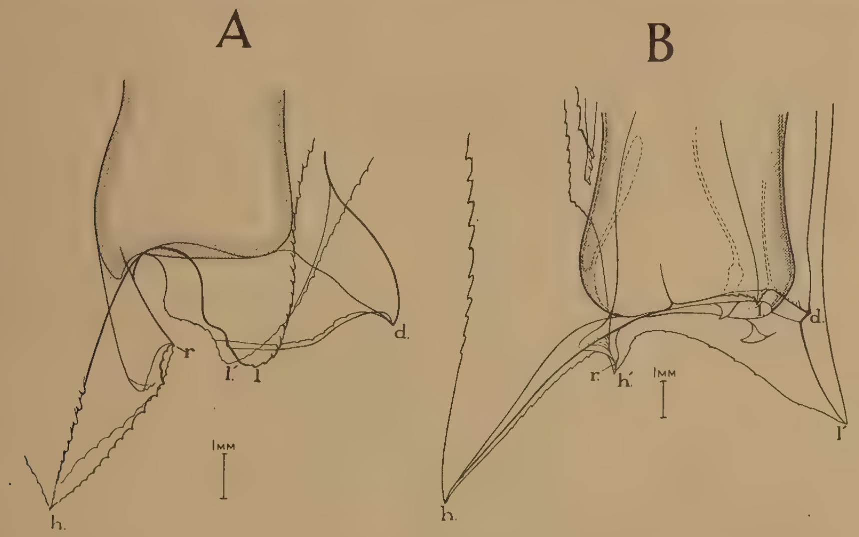


Text-fig. 14.—a, *Abyla dentata*, Bigelow. × 6·5. Dorsal view of the base of the posterior nectophore; b, *Abylopsis tetragona* (Otto). × 11. Same view. *r*, The ridge at the base of the mouth-plate; *d*, dorso-basal tooth; *l*, latero-basal teeth; h, h^1, basal ends of the right and left hydroecial walls.

There are two small, pointed, prominent, basal projections (Text-fig. 15*b*) underlying the two lateral "Gefässplatten." They are referred to by Haeckel as "the distal prolongations of the two dorso-lateral edges," but appear to be independent formations connected with the close proximity of the "Gefässplatten."

I observed that numerous specimens taken alive in the Gulf of Algeciras in March, 1931, swam slowly by rhythmical contraction of the posterior nectophore. Like many salps that I observed at the same time they swam in open spiral courses, with the hydroecium of the posterior bell on the inner side of the spiral, and with stem contracted. It was only occasionally that the minute anterior bell pulsated, which it did with a rhythm more rapid than that of the posterior bell.

Bigelow (1931) has already referred to two criteria for separating the loose anterior nectophore from that of *A. eschscholtzii*. A third one I would mention is that in *A. tetragona*, the length of that part of the ventral wall of the nectosac that extends from the velum to the point where the pedicular canal joins the subumbral canal system is shorter than the other part between this junction and the apex of the nectosac. In *A. eschscholtzii* the reverse holds true.

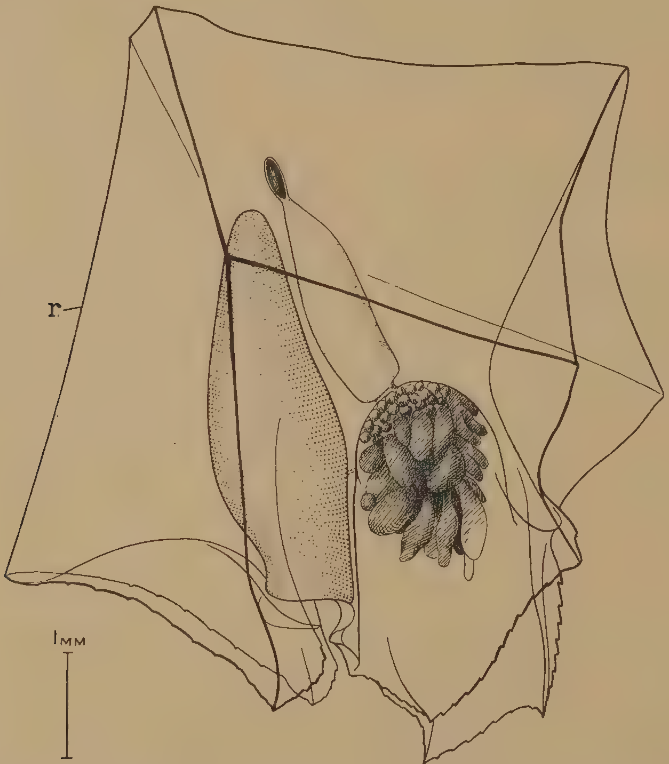


TEXT-FIG. 15.—A, *Abyla dentata*, Bigelow. B, *Abylopsis tetragona* (Otto). × 6·5. Lateral views of the bases of the posterior nectophores to show the ridge, *r*, at the dorsal side of the flattened elliptical area of the mouth-plate. Lettering as in Fig. 14.

Enneagonum hyalinum, Quoy and Gaimard, 1827 (=*Cuboides vitreus*, Quoy and Gaimard, 1827).

Specimens of both stages were taken regularly at the weekly station, two outside stations, and three intermediate stations from 4th January until 17th July. For the rest of the year no specimens were taken. The estimated total numbers taken are 36 polygastric and 286 eudoxids. Twenty-one specimens were taken at one "vertical distribution" station in daylight, a single polygastric specimen at the surface, 11 eudoxids at 8 m., 2 at 16·5 m., and 7 a little deeper still.

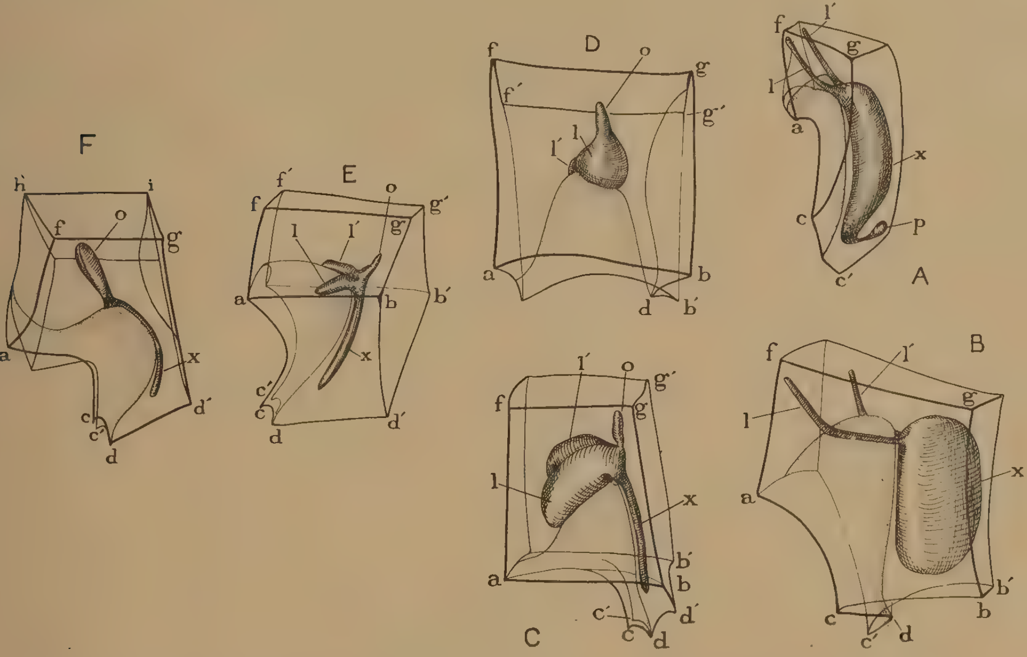
Huxley (1859) carefully homologized the facets of the polygastric nectophore which he called *Abyla vogtii* with those of *Abylopsis tetragona* and *Bassia bassensis*. The essential difference was, he said, that there is a median dorsal ridge instead of a pentagonal dorsal facet (see Text-fig. 22). This homology appears to have been overlooked by some subsequent authors, especially Chun (1892), whose beautifully executed lithographs obscure this point completely. One is at first tempted to believe that this dorsal longitudinal ridge, which is found in the gonophore as well, is homologous with the dorsal ridge in *Diphyes*, and is a primitive feature ; but *Enneagonum* is the only Abylid known with such a ridge in the anterior nectophore, and it seems more probable that it is a secondary feature, perhaps introduced after the loss of the posterior nectophore to restore balance in some way.



TEXT-FIG. 16.—*Enneagonum hyalinum*, Quoy and Gaimard. × 16. Lateral view of a nectophore to show its homologies with those of *Abylopsis tetragona* and *A. eschscholtzii*. *r*, The dorsal median ridge peculiar to this species. The appendages are shown diagrammatically.

I do not share the view of some authors that Quoy and Gaimard's *Enneagonum hyalinum* cannot be recognized, or that there is more than one species to which the description and figures could apply, and for this reason I am obliged reluctantly by the rules of nomenclature to reintroduce their name. The description and figures, which will fit no other species, together with the fact that the polygastric and eudoxid stages were found together, and the fact that the authors commented on a similarity in the behaviour of each when alive—all these points leave me without the slightest doubt about the identity of Quoy and Gaimard's species.

As to the meaning of Quoy and Gaimard's " seconde partie " which is enclosed in " la moyenne cavité," or hydroecium, I take it to be the gonophore of one of the eudoxids, since it has five teeth and a lateral canal. The figures in Quoy and Gaimard's plate 2D can be recognized as follows: Fig. 1, lateral view from left side, showing the nine points, but not illustrating the full extent of the hydroecial walls; fig. 2, basal view looking into hydroecium; fig. 3, apical view (*cf.* Chun, 1892, pl. xi, fig. 2); fig. 4, lateral view (*cf.* Chun, fig. 4); fig. 5, young gonophore; fig. 6, nectosac and somatocyst with apical projection, and appendages. In fig. 1 the arrangement of the nine points is correct, although they could not be seen as illustrated from any one view-point. It should be noticed that in their explanation of the plate these naturalists state that the apical angle "se trouve toujours en dessous." This seems to imply that the live animals take up that position.



Text-fig. 17.—Diagrams of the bracts of Abylid eudoxids. A, "*Cymba*" type (*Abyla leuckartii*); B, "*Amphiroa*" type (*Abyla trigona, A. haeckeli*); C, E, "*Aglaisma*" type (*Abylopsis tetragona, A. eschscholtzii*); D, "*Cuboides*" (*Enneagonum*); F "*Sphenoides*" (Bassia). The bracteal cavities have been dotted, and the phyllocysts hatched. The bracts are so orientated as to show their homologies. *a b*, Cross ridge; *a c d*, hooked baso-lateral wall of bracteal cavity; $d\ d^1$, baso-sagittal ridge; *h i*, apico-sagittal ridge; $c\ c^1\ b\ b^1$, square, basal facet; $b\ c$, $b^1\ c^1$, baso-lateral ridges.

It seems opportune to invite special attention to the Abylopsine relationship of *Enneagonum*; and some detailed morphological considerations will make the understanding of it more easy.

The eudoxids of the Abylopsinae are of the "*Aglaisma*," "*Cuboides*" and "*Sphenoides*" types, and their study reveals their homologies with those of the *Abylinae*, which are of the more generalized "*Amphiroa*," "*Cymba*" and "*Ceratocymba*" types. The "*Aglaisma*" of *Abylopsis tetragona* may be regarded as the most generalized of the Abylopsine eudoxids; and the asymmetrical "*Cymba*" and "*Ceratocymba*" are perhaps the most generalized of the Abyline eudoxids, because they have no cross ridges (Text-fig. 17 *a*, *b*), running from the baso-ventral rim of the bracteal cavity of the bract to its dorso-lateral ridges, and the dorsal facet is not divided by the ridge $b\,b^1$; most of their other ridges and facets can be homologized with those of the "*Aglaisma*" of *Abylopsis tetragona*. Development from this "*Aglaisma*" type seems to have led in two directions, firstly to the suppression of the hooked baso-lateral walls of the bracteal cavity and of the baso-sagittal ridge (Text-fig. 17, D, $d\,d^1$, "*Cuboides*"); and secondly to the enlargement of these same parts in *A. eschscholtzii*. The bract of *Bassia* ("*Sphenoides*") seems to be a retrograde development of the *eschscholtzii* type, in which the cross ridge $a\,b$ has been suppressed, and the paired (ventral) horns of the phyllocyst have been lost, whilst an apico-sagittal ridge (Text-fig. 17F, $h\,i$) has transformed the original rectangular facet $f\,g\,f^1\,g^1$ of the other types into a pair of apical facets, $f\,g\,h\,i$, $f^1\,g^1\,h\,i$.

The bracts of "*Aglaisma*" and "*Sphenoides*" differ from that of "*Amphiroa*," which has a square basal facet $c\,c^1\,b\,b^1$, in the possession of a new baso-sagittal ridge $d\,d^1$, the baso-lateral ridges $b\,c$, $b^1\,c^1$ being absent. In "*Cuboides*" the baso-sagittal ridge $d\,d^1$ has shortened to the vanishing point d. Even in *Abylopsis tetragona* (Text-fig. 17*c*) it is of variable length, being sometimes very much shorter than is shown in the figure.

The fact that the oily content of the phyllocyst collects in an apical horn in "*Aglaisma*" and in a dorso-basal horn in "*Cymba*" and "*Ceratocymba*" is probably due to differences in habit and posture.

The differences in shape of the phyllocyst in Diphyids and Abylids can generally be correlated with differences in the relative volumes of the parts of the bracts. In *D. bojani* it will be remembered that there is a very thin bract, and that no apical horn is developed at all. In *Bassia*, where the basal part of the bract is long and narrow, we find an elongated basal horn; so in "*Cuboides*" where the basal part of the bract has been suppressed, we find no basal horn at all.

Abylopsis eschscholtzii (Huxley, 1859).

About 70 specimens of the polygastric stage and upwards of 320 eudoxids are estimated to have been taken at the weekly station three miles East of Low Isles, at four outside stations, and intermediately during the greater part of the year. Between 4th January and 7th June they were taken only twice, on 17th March at an intermediate station, and on the next day at an outside one.

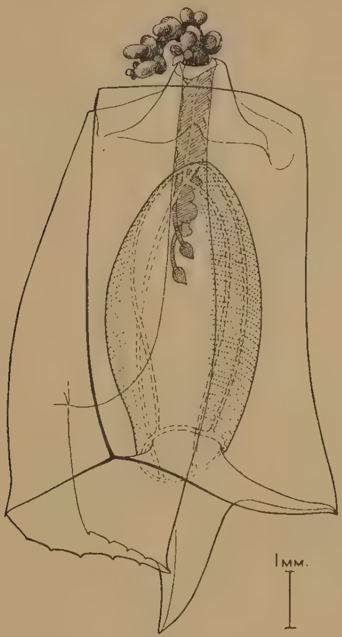
Forty-four specimens were taken at vertical distribution Station 16, the four polygastric specimens coming from between the surface and a depth of 8 metres. Sixteen more were taken at vertical distribution Station 68, the six polygastric specimens being taken at about the same depth.

Some of the bracts of the eudoxids are parasitized by young Hyperiid amphipods, which probably feed on the reserve food stored in the phyllocyst. Hyperiids were found also in *Sulculeolaria quadrivalvis*, apparently feeding on the musculature of the bell of the posterior nectophore, and also in *Enneagonum hyalinum*, close to the phyllocyst of the bract of the eudoxid. In *Lensia subtiloides* what may be similar amphipods were found close to the somatocyst of the nectophore.

Bassia bassensis (Quoy and Gaimard, 1833).

Specimens of both stages were taken in most of the catches made at inside, outside and intermediate stations throughout the year, except for a period of nearly three months between 17th March and 7th June. The numbers estimated to have been taken are about 80 in the polygastric stage, and 350 eudoxids. The material is not in very good condition, and includes only one complete polygastric specimen, which has a small, though unmistakable reserve nectophore bud.

I can see no trace of the almost obsolete ridge marked by a very small pointed prolongation of the distal wall of the hydroecium of the posterior nectophore figured and mentioned by Huxley. It is neither figured nor mentioned by Haeckel. Bigelow (1911*b*) says that the "right" lateral ridge is entirely suppressed. In my judgment it is not one of the laterals which has been suppressed, but the median dorsal ridge. The after end of the posterior nectophore is twisted round slightly (Text-fig. 21), so that the posterior end of the right lateral is brought near the middle line. On the opposite side the left ventral ridge bounding the hydroecium forms a keel near the middle line. *Bassia* has no caecal prolongation of the somatocyst such as is found in *Abylopsis*, and the whole somatocyst seems to have been secondarily displaced to a forward position. There is in its ventral side a cleft-like compartment, apparently bounded within by a membrane, and running nearly the whole length of the somatocyst. At its distal end is usually found the oil globule. The somatocyst of most Siphonophora is divided longitudinally in a similar way. Some individual variation is observable in the branching of the radial canals.



TEXT-FIG. 18.—*Bassia bassensis* (Quoy and Gaimard). × 8·5. Dorsal view of posterior nectophore, showing how the posterior end of the right lateral ridge twists up on to the dorsal side, and the left hydroecial fold forms a ventral keel in the centre line.

The normal arrangement appears to be that figured by Bigelow (1911*b*), pl. 14, fig. 9, where the four canals make a single junction with the pedicular. In some nectophores the laterals join the dorsal midway between the junction of the pedicular and the blind apex of the sac, the right lateral effecting a junction proximally to the left.

Diphyidae. Eschscholtz, 1829.

Galeolarinae, Chun, 1897 + *Muggiinae*, Bigelow, 1911 (pars) + *Diphyinae*, Moser, 1925.

Galettinae, Stechow, 1921.

Galeolarinae, Chun, 1897.

Taxonomy.—There are still a number of questions to be settled before the species of the genus known for so long as *Galeolaria*, and characterized by looped lateral canals in the posterior nectophore, can be clearly delimited. A group of species included with them by Moser and others, *campanella*, *truncata*, *subtilis*, *subtiloides*, *multicristata* and *fowleri*, has been separated off (see p. 364) as a new genus *Lensia*. Its species have simple and not looped lateral canals in the posterior nectophore, and have affinities with the Diphyinae.

Available data lead to the tentative conclusion that there are at least six or seven species. Firstly there is a group of four—*biloba*, *australis* (these may prove to be one and the same), *chuni* and *turgida*—all without basal teeth on the anterior nectophore, some of them, if not all, passing through a young phase in which there are no cross lateral canals, and all possessing an undivided or slightly notched basal flap in the posterior nectophore. There remains a group of three, *monoica*, *quadrivalvis* and *quadridentata*, all with basal teeth in both the anterior and the posterior nectophores, but none of them, as far as known, passing through a young stage which lacks the cross laterals. Whether there are intermediates between *quadrivalvis* and *quadridentata* is uncertain.

Nomenclature.—If this delimitation of species can be definitely established, the two groups may be given definite subgeneric or generic rank, the latter group retaining the old name *Sulculeolaria*, and the former the name *Galetta* (=*Galeolaria*).

Genus *Sulculeolaria*, Blainville, 1830.

Genotype.—*Sulculeolaria quadrivalvis*, Blainville, 1834, Lesueur MS.

Synonymy: Sulculeolaria, Blainville, 1830, p. 126; Blainville, 1834, p. 138.
Galeolaria (pars), Quoy and Gaimard, 1833, p. 43; Chun, 1897, p. 16; Haeckel, 1888, p. 150; Lens and Van Riemsdijk, 1908, p. 56; Bigelow, 1911*b*, p. 233; 1918, p. 415; 1919, p. 336; Moser, 1925, p. 135; Browne, 1926, p. 66; Candeias, 1929, p. 270; non *Galeolaria*, Lamarck, 1818, p. 371; Vanhöffen, 1906, p. 15.
Epibulia, Chun, 1888, p. 765 (1157).
Galetta (pars), Stechow, 1921, p. 261; Bigelow, 1931, pp. 540, 549.

Sulculeolaria is a valid generic name, since its publication by Blainville in 1830 was accompanied by a sufficiently good description. But the three specific names cited by him at that time were not accompanied by indications, definitions or descriptions within the meaning of the rules,* since, according to the first opinion rendered by the International Commission on Zoological Nomenclature, one cannot accept the reference by

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* See International Rules of Zoological Nomenclature reprinted in 'Proc. Biol. Soc. Washington,' XXXIX, 1926, p. 81.

Blainville to Lesueur's unpublished figures as an "indication" of the identity of such species. In 1834, however, Blainville's citation of the same three specific names was accompanied by a good figure of the posterior nectophore of the first of them under Lesueur's manuscript name *S. quadrivalvis*.* The species so designated *ipso facto*† became the genotype of the monotypic genus *Sulculeolaria*, Blainville, 1830. Bigelow (1911*b*) selected *Galeolaria australis*, Q. & G., as the genotype of *Galeolaria*, Blainville, 1830. Blainville's use in 1830 of *G. australis* is not accompanied by an "indication" save a reference to a figure at that time unpublished, so that *G. australis* must be assigned to Quoy and Gaimard, 1833. Quoy and Gaimard's figure shows no somatocyst, so that it cannot be identified with actual specimens of the species that Bigelow (1911*b*) calls *australis* rather than with those referred by Candeias (1929) to *turgida*, Gegenbauer. We shall assume that *australis*, Q. & G. included all toothless forms, and that the name is applicable to the residual species after the separation off of *turgida*, *chuni* and any other toothless species. *Galeolaria* was preoccupied by Lamarck in 1818 for a worm, and was displaced by *Galetta*, Stechow (1921). If *Galetta australis* (Q. & G.) is considered to be congeneric with *Sulculeolaria quadrivalvis*, Blainville, then *Galetta* becomes a synonym of *Sulculeolaria*, which has page preference over *Galeolaria*; but the toothed forms may be retained conveniently in a separate genus *Sulculeolaria*, genotype *S. quadrivalvis*, Blainville, 1834, and the untoothed forms in a genus *Galetta*, Stechow, 1921 (=*Galeolaria*, Blainville, 1830, *non Galeolaria*, Lamarck, 1818), genotype *G. australis*, Quoy and Gaimard, 1833.

Sulculeolaria quadrivalvis, Blainville, 1834.

MATERIAL.—Parts of twenty specimens coming both from inside the Barrier and the deep water outside, as well as intermediately. Of the 19 hauls in which the species occurred, 10 were made at the weekly station three miles East of Low Islands on 17th August, 11th and 20th September, 2nd October, 11th November, 27th December, and 7th June, and 1 inside Cook's Passage on 28th February; 3 at outside stations, namely outside Trinity opening on 20th October, outside Cook's Passage on 28th February, and outside Papuan Pass on 18th March; and 5 at intermediate stations in Trinity opening on 24th August, 6th September and 19th November.

The 15 anterior and 15 posterior nectophores (except one, taken at 8 m. in a closing net at St. 16, three miles East of Low Isles at 11.15 a.m.) were all taken in vertical or oblique hauls of open nets. In ten cases there were associated a single anterior and posterior nectophore, which probably formed the two nectophores of a single specimen.

The criterion for identification of the anterior nectophores has been in each case the presence of the two characteristic "dorsal" teeth (Text-fig. 23, *do*). At present there is nothing known to distinguish the posterior nectophores of *S. quadrivalvis* and *S. quadridentata*, which Bigelow (1918) redescribed. I have examined specimens of the latter taken by the R.R.S. "Discovery" off Cape Verde and at other Atlantic stations, and others taken by myself off Kingstown, St. Vincent, B.W.I.

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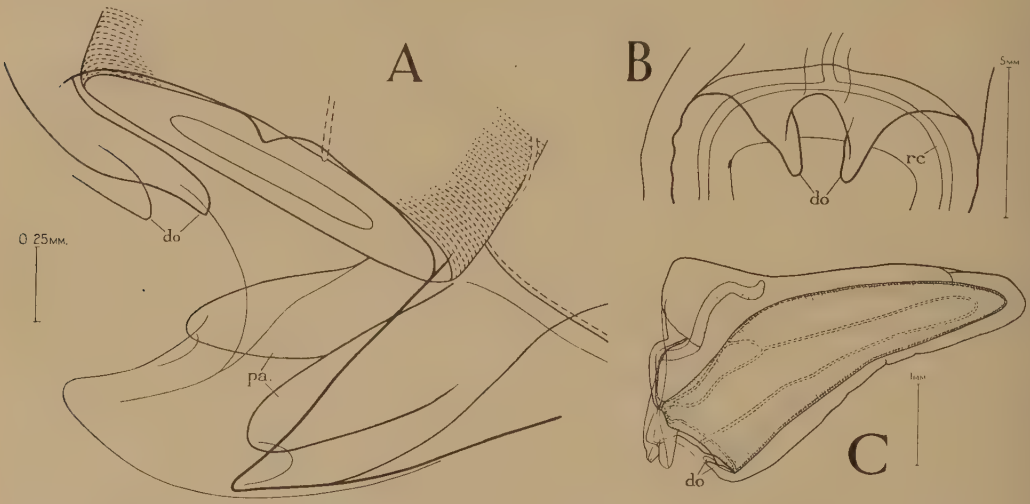
* Although Blainville's figure might represent the posterior nectophore of either *quadrivalvis* or *quadridentata*, yet the name *quadrivalvis* must be retained for the residual species after *quadridentata* and any others have been separated off.

† See Opinion 46 rendered by the International Commission on Zoological Nomenclature, reprinted in 'Proc. Biol. Soc. Washington,' XXXIX, p. 96.

Four of the fifteen specimens have small lateral teeth comparable with that figured by Bigelow (1931, fig. 197), one has teeth slightly longer and narrower, two have very slight eminences, and the rest have no lateral teeth at all. In one specimen, where lateral teeth were absent, the two dorsals were abnormally short.



TEXT-FIG. 19.—*Sulculeolaria quadrivalvis*, Blainville. A, Base of anterior nectophore, × 45, to show the oval vertical pads, *p a*, on the inner sides of the two lamellae of the mouth-plate; B, oral view of the nectosac, × 45, to show the two dorsal teeth, *d o*, and the ring canal, *r c*, in the velum; C, lateral view of anterior nectophore, × 12, in the position for horizontal progression.

Sulculeolaria monoica (Chun, 1888).

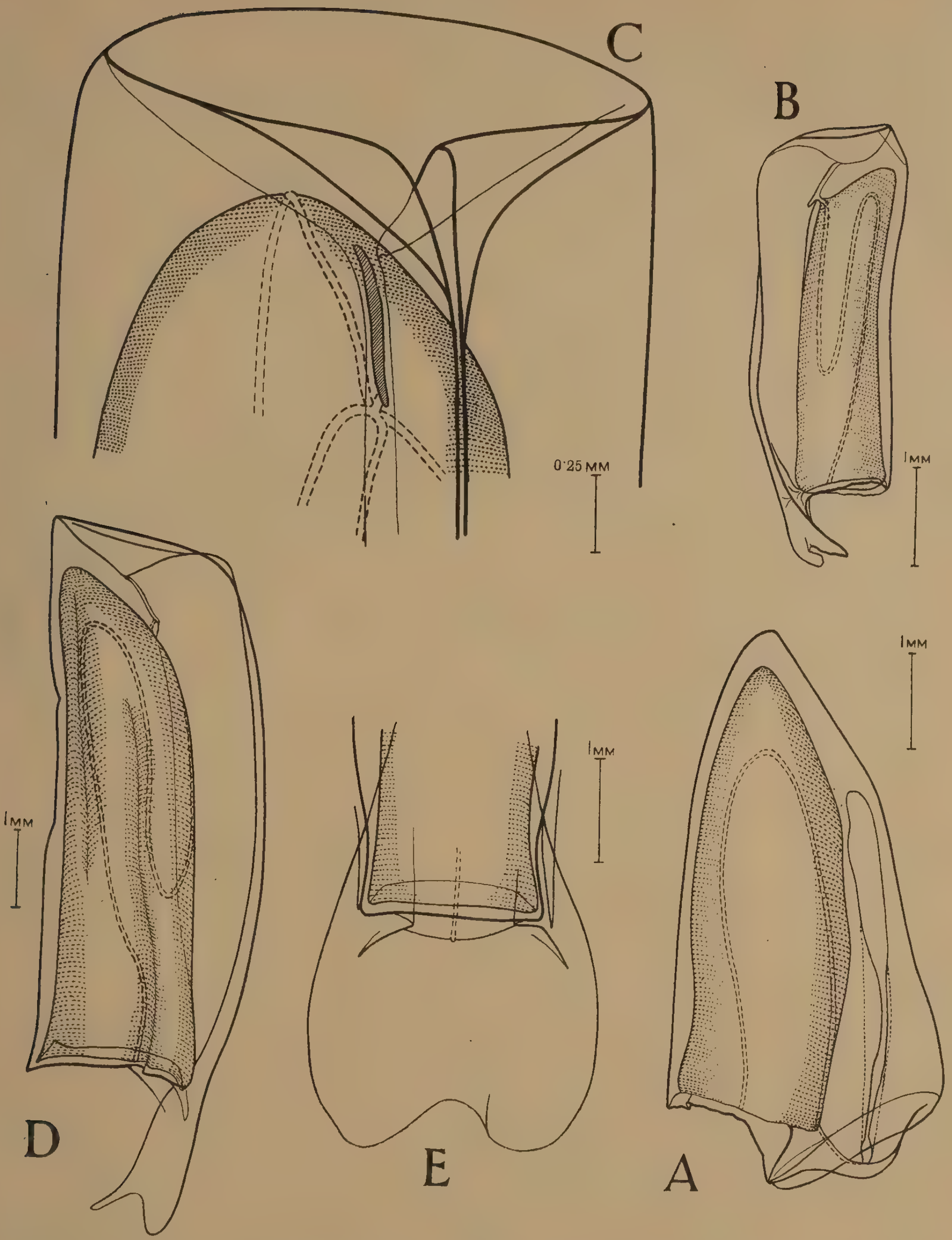
A single, crushed, anterior nectophore 8·5 mm. in length was taken at St. 16 in a closing silk tow-net, at a depth of 3·1 metres on 3rd October.

The characteristic narrow dorso-basal and two narrow latero-basal teeth, two small lateral flaps, two large ventro-basal wings with projections on their inner edges, and small somatocyst are sufficient for assigning the specimen to this species. I have recently seen a similar nectophore from the Atlantic which has very broad latero-basal teeth, and it is probable that two species will have to be recognized.

Galetta chuni (Lens and Van Riemsdijk, 1908).

The chief character by which Lens and Van Riemsdijk (1908) differentiated this species was the absence of lateral commissures between the dorsal and lateral radial canals. Browne (1926) maintained that the chief difference between *G. chuni* and *G. australis* was the longer somatocyst in *chuni*, the younger nectophores of which had at first no lateral commissures, but acquired them in the later stages of development.

I now have to record from the Great Barrier Reef 22 anterior nectophores without marginal teeth in which the lateral commissures are certainly absent. With these anterior nectophores were associated a number of loose posterior nectophores of the *Galetta* type; that is, with folded lateral canals, which appear to be of at least three types, none of them corresponding with those of *quadrivalvis*, *quadridentata*, *monoica* or



TEXT-FIG. 20.—*Galetta chuni* (Lens and Van Riemsdijk). A, Anterior nectophore, × 15·5, showing the small extent of the hydroecial cavity, the short mouth-plate and the long somatocyst, the basal part of which is unnaturally shrunken (a more normal outline is indicated in broken line); B, posterior nectophore with damaged apex, × 16, showing the folded lateral radial canal and notched lamella or ventral wing; C, ventro-lateral view, × 50, of the apex of the posterior nectophore of a specimen taken by the "Terra Nova" Expedition, 1910–13, at 6° 10′ N., 24° 5′ W. (scale = 0·25 mm.); D, lateral view, × 12·5, of the same; E, dorsal view, × 17, of the mouth-plate or ventral wing of the last specimen.

biloba. One specimen has a long rounded lamella which is devoid of an emargination. All of those others which are in reasonably good condition have a notched lamella (Text-fig. 20), one side of which is usually rather longer than the other. In one or two the notch is deeper than in the majority, in which it is shallow. A much larger series of 34 anterior and 35 posterior nectophores brought back from the Atlantic by the "Terra Nova" 1910-13 Expedition enables me to describe the posterior nectophores of *G. chuni* as having a notched lamella. Besides 15 anterior nectophores in which the somatocyst is relatively long (Text-fig. 20*b*), there are 7 in which it is very short. It soon became apparent that a short somatocyst and absence of cross-lateral canals could be correlated with two other characters, namely, a larger mouth-plate and hydroecial cavity, and a relatively greater distance between the apex of the nectosac and the apex of the nectophore, and a different origin of the lateral canals. I have had to abandon the laborious search for more specimens in the tow-nettings with which to test this difference, but that this second series belongs to a different species is borne out by the existence of a series of seven similar specimens I took off Kingstown, St. Vincent, B.W.I., in February, 1931. If such a correlation can be definitely established, it will mean the existence of a second species, related to *G. chuni* in having no cross-lateral canals in the early stages. Gegenbaur's name *turgida* may be used for it, since there is only a very small somatocyst, which we may suppose Gegenbaur overlooked.

Specimens of a *Galetta* with neither marginal teeth nor lateral commissures have now been recorded of lengths between 1·23 mm. and 12 mm. Browne (1926) held that because some specimens of *Galeolaria biloba* in the length group 5-7 mm. have commissures and others have not, whilst from the 15–20 mm. group specimens without commissures are absent, the specimens without commissures are early growth stages of the larger forms.

Measurements of Anterior Nectophores of Galetta chuni.

[Unit of measurement = 1 millimetre.]

Station.	Nectophore.		Somatocyst.		Mouth-plate. Length.	Distance between forward end of nectophore and apex of nectosac.
	Length.	Depth.	Length.	Diam.		
20, c.	1·23	0·26	1·06	0·26	0·15	0·17
50, c.	2·2	1·1	1·14*	..	0·24	0·24
20, c.	2·4	1·2	1·1	0·15	0·15	0·15
50, s. 170 m.	3·8	1·9	2·6	..	0·38	0·23
19, 1 m.–c.	3·9	1·8	2·6	..	0·27	0·26
50, s. 400 m.	4·8	2·4	3·0	..	0·47	0·33
50, s. 170 m.	4·9	2·4	2·66	0·38	0·47	0·38
19, 1 m.–c.	4·9	2·4	2·0	..	0·54	0·18
50, s. 400	5·0	2·7	2·9	..	0·47	0·27
50, s. 170 m.	5·3	2·2	2·66	..	0·66	0·33
20, c.	5·4	2·6	2·4*	0·13	0·47	0·19
26, c.	5·8	2·8	3·9	..	0·66	0·3
50, s. 400 m.	5·9	3·0	3·8	..	0·66	0·33
13, s.	5·9	3·1	4·0	..	0·54	0·27
50, s. 400 m.	6·2	3·0	4·0	..	0·66	0·3

An asterisk (*) denotes that the somatocyst is curved, and was measured along the chord.

with commissures. If this can be definitely confirmed for a single species, it will be a point of some importance. The smallest of the three anterior nectophores without marginal teeth, but with lateral commissures and a long somatocyst (adult *G. chuni*) taken by the Expedition measured 5·5 mm. by 3 mm., and the smaller of the two with lateral commissures and a short somatocyst (adult *G. turgida*) 5·1 mm. by 2 mm. The largest specimens measured respectively 9 mm. by 4·5 mm., and 9·5 mm. by 4·8 mm.

MEASUREMENTS.—Fifteen specimens of *G. chuni* were measured. Their lengths are from 1·23 mm. to 6·2 mm. There is a corresponding range in the length of the somatocyst of from 1·06 mm. to 4 mm. The depth of the anterior nectophore is half of its length, and the length of the mouth-plate about one-tenth.

Galetta turgida (Gegenbaur, 1854).

Six specimens; all except one, which was taken inside on 20th September, from three outside stations in March and October.

Though none are in a good state of preservation, it will be of interest to record the presence of these anterior nectophores characterized by the absence of teeth, very small somatocysts, and lamellae and hydroecial cavities relatively larger than in *G. chuni*. The critical definition of the species must be deferred until a more abundant material is available.

That such a species is to be distinguished from *G. australis* is made probable by the record of Candeias (1929), and by the capture I made recently of seven young specimens off St. Vincent, B.W.I.

As Bigelow has already suggested (1931), Gegenbaur's name seems to be both applicable and available.

DIPHYINAE, Moser, 1925.

With the exception of *Diphyes arctica* and *D. antarctica*, all the species generally assigned to *Diphyes* and *Diphyopsis* may be classified in three natural groups which can conveniently be given generic rank. When it is remembered that the total number of species of Siphonophora is only about 120, it is not surprising to find that these genera contain only two or three species each. Some difference of opinion has existed in the past on the question of whether the presence of a special swimming-bell in the eudoxid is sufficient warrant for separating certain species as a genus *Diphyopsis*. The three species in question are *D. dispar*, which is the genotype of the monotypic genus *Diphyopsis* (Haeckel, 1888), *D. bojani* (Chun), and *D. chamissonis*, Huxley. In view of the peculiarity of their eudoxids, the possession by the polygastric stages of these three of certain characters which are not found in other Diphyinae fully justifies the recognition of the genus *Diphyopsis*. The anterior nectophores of all three possess well-marked oral teeth, an undivided mouth-plate, and a deep hydroecium. The posterior nectophores of the first two are strikingly similar in every detail and quite unlike those of other species. *D. chamissonis* has evidently lost its posterior nectophore, and for that reason may be regarded as less closely related to *dispar* and *bojani* than each is to the other. It seems, however, hardly worth while to create two separate subgenera. A loss or reduction of the posterior nectophore is found elsewhere, for instance in *Enneagonum*, and is a phenomenon that apparently has taken place independently in more than one group.

Secondly we have a small group of two species closely related to each other, but less so to the rest—*D. spiralis*, Bigelow, 1911, and *D. mitra*, Huxley, 1859. Here again consideration of the sum of the characters of the eudoxid and polygastric stages justifies the separation of the two species as a new genus with genotype *D. mitra*, Huxley. The peculiar lancet-shaped wings of the mouth-plate, the shallow hydroecium with truncated apex and the peculiarly shaped eudoxid bract and elongated gonophores are characters that mark species of this genus.

Thirdly there is a group of two species, *D. appendiculata* and *D. contorta*, which resemble each other more closely than the members of other groups in the shapes of the anterior and posterior nectophores,* the mouth-plate, and the hydroecial cavity of the anterior nectophore. Free eudoxids of *D. contorta* have not been described, and it is open to doubt whether *Eudoxia campanula*, Leuckart, which is ascribed to *D. appendiculata*, or any other known eudoxid, is really the eudoxid of that species.

Left over for consideration are two interesting species—*D. arctica*, of which there was taken a single eudoxid, and *D. antarctica*, with which, though not represented in this collection, I am familiar. It may be regarded as a primitive representative of the first group.

Proceeding now to a discussion of the proper names of the genera of Diphyinae here defined, the first genus is found to contain a species, *D. dispar*, that is at the same time the genotype of Cuvier s *Diphyes*, 1817, and of Haeckel's *Diphyopsis*, 1888. The latter, therefore, must give way to *Diphyes*, Cuvier.

The first available name for the second genus is *Eudoxoides*, Huxley, 1859. This name Huxley used for the bract of the eudoxid of what we now know to be *D. mitra*.

The only available old names for the third genus are *Eudoxia* and *Cucullus*. Both, however, were originally applied to the eudoxids of *D. dispar*, and therefore are synonyms of *Diphyes*, Cuvier. In consequence there is no course open but to give, as I now do, a new name, *Chelophyes*,† to this new genus, which has for its genotype *D. appendiculata*, Eschscholtz.

Diphyes, Cuvier, 1817.

Diphyopsis, Haeckel, 1888.

Diphyes dispar, Chamisso and Eysenhardt, 1821.

Specimens of polygastric and eudoxid stages were taken at both inside and outside stations, as well as intermediately, from early September, 1928, to the end of the following March.

The eudoxid (Text-fig. 21) has hitherto been known as *E. lessoni*, but the only reasons for identifying it with Eschscholtz's *Eudoxia lessonii* are that he figures what may be taken as a long pedicular canal, and a nectosac which is curved in a manner that somewhat recalls that of *D. dispar*. At the same time it is difficult to see why he should have drawn the bract and the mouth of the special swimming-bell of *D. dispar* in the way represented in his figure.

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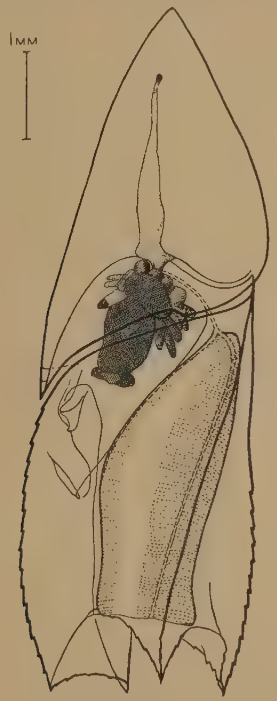
* The posterior nectophore of *E. mitra* bears some resemblance to those of *Chelophyes appendiculata* and *C. contorta*.

† The allusion is to the claw-shaped outline of the hydroecium as seen in a lateral view.

It might be argued that the figure of *E. lessonii* is more like the eudoxid of *Heteropyramis maculata*, especially as Eschscholtz says that the bract is " an dem freien Ende spitz." However, the " Schwimmhölenstuck " is too long and the nectosac too wide for *H. maculata*, although the mouth of the figured specimen of *E. lessonii* is characteristic. Again, should the inferior canal of the somatocyst in Eschscholtz's figure be really a bracteal canal and not the canal in the peduncle of a special swimming bell or gonophore, the identification with *D. arctica* would have to be considered, although it seems very unlikely.

The identification with Quoy and Gaimard's *Diphyes cucullus* seems to have very little foundation. Huxley's (1859) *Eudoxia lessonii* is certainly *D. dispar*, although he could not distinguish between it and Leuckart's *E. campanula*, which has no special swimming bell, and a rounded mouth-plate to the gonophore, besides being much smaller.



TEXT-FIG. 21.—*Diphyes dispar*, Chamisso and Eysenhardt. × 13. Lateral view of the eudoxid.

Eschscholtz's *Ersaea gaimardi* may possibly be this species. The shape of the special swimming-bell and its mouth resemble *D. dispar*. Huxley regarded *E. quoyi*, Eschscholtz, in addition to *E. gaimardi* as a synonym of his *E. lessonii*, but the figures of the special swimming-bell of that ersaeid make this very improbable.

Huxley's figure of *Eudoxia lessonii*, which is the earliest recognizable one of the eudoxid of *D. dispar*, omits details of the apex of the special swimming-bell and radial canals, although he mentions that these branch off a little below the apex of the nectosac. In the figures of Fewkes (1881) and of Agassiz and Mayer (1902, fig. 41) the canals are represented as meeting at the apex. In their fig. 40 the canals do not meet at the apex. The apex of the nectosac and the arrangement of the canals are sound criteria, and are not subject to much variation. Haeckel's (1888) figure is poor, and Lens and Van Riemsdijk's (1908) not good.

The most satisfactory figure of the eudoxid is that of Mayer (1900, fig. 96), although it does not show mature gonophores.

Now I will give a detailed description of the bract, special swimming-bell and gonophore.

The "sutural" surface of the bract of the eudoxid makes an acute angle with the dorsal side. The oral end of the sutural surface extends slightly beyond the level of the apex of the bracteal cavity. There are two teeth on the margin of the bract of the eudoxid, one lying just over the left ventral ridge of the swimming-bell, and the other just over the hydroecium, and projecting further in the oral direction. I took one eudoxid of this species off St. Vincent, B.W.I., in which the hydroecial fold and tooth were on the right side instead of on the left, which is the normal condition. The subumbrella of the special swimming-bell, which is closely coupled to the bract, does not extend very far into the saddle-shaped aboral part of the bell. The apex of the nectosac does not quite reach the level of the junction of the radial canals. The distance from its blind end to the canal-junction is relatively short. The terminal oral end of the nectosac is cylindrical and relatively long, the hydroecium not extending much below its middle region. The dorsal teeth are relatively long and wide apart. The pedicular canal is very long and the hydroecium is correspondingly deep. On the right side of the dorsal end of the "saddle" is a projection or tooth, rather similar to that found in the hydroecium. The special swimming-bell (text-fig. 31) figured by Moser (1925, p. 191) is so unlike any that I have studied, and indeed so unlike that drawn in her sketch (pl. viii, fig. 2) of the whole eudoxid, that I think it may have been included by mistake in her description of the species.

The gonophore shown in her text-fig. 32 is distinctly recognizable, but does not clearly indicate the run of the ridges. What is described and figured as "ein kleiner spitzer Ausläufer" appears to be a short transverse ridge, sometimes only visible in its middle region as a small projection, that runs across the dorsal surface rather above the level of the apex of the nectosac from the upper part of the right* dorsal ridge to the upper part of the left ventral, and limits the oral end of the peduncle, which is very much flattened dorso-ventrally. The left dorsal ridge is incomplete above and does not reach this transverse ridge. The four radial canals lie under the ridges, and the oral ends of the two ventrals curve in towards one another. The dorsal teeth are broad and lie close to one another. Moser's gonophore is considerably more twisted than any I have seen. The apophysis or peduncle is very much flattened obliquely on the left side, where it is pressed against the bract as described by Moser. The left ventral ridge which forms one side of the hydroecium extends up on to the projecting ventral edge of the flattened peduncle, and curves round to the right to meet the apex of the peduncle. The right ventral ridge on the other side of the hydroecium is twisted above towards the dorsal side, and curves round to the apex of the peduncle, so that the upper part of the hydroecium is wide, shallow and twisted. The left and right ventral ridges meet above, and then join the left dorsal ridge on the ventral edge of the flattened apophysis. Younger gonophores fit into the hydroecial cavity of the older ones. All the gonophores borne by any individual eudoxid appear to be of one sex.

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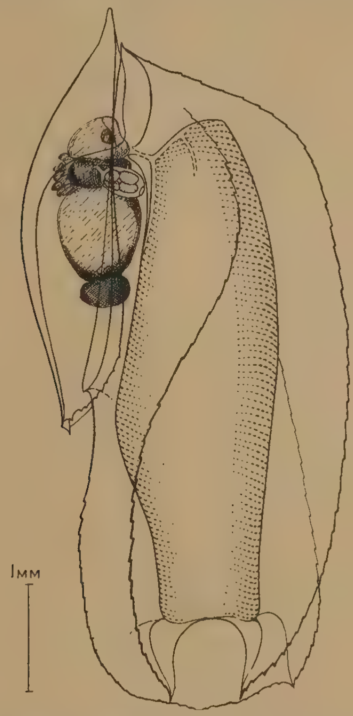
* The gonophores are of two kinds, the mirror-images of one another, so that the terms "left" and "right" may have to be reversed.

Diphyes bojani (Eschscholtz, 1825).

Polygastric and eudoxid stages were taken at inside and outside stations, as well as intermediately from the latter part of August to the middle of March.

The variations in the shape of the nectophores of the polygastric stage have been dealt with by Bigelow (1911*b*); and their study led him to a settlement of the synonymy.

The eudoxid (Text-fig. 22) appears at first sight very unlike other Diphyid eudoxids because of the shield-like bract. A further comparison shows that it is essentially similar, except that the semi-annular phyllocyst of the young bract never develops a secondary upstanding portion. The bract remains thin, the "sutural" surface being roughly parallel with the dorsal side as in the developmental stages of the eudoxids of *D. dispar* and *D. chamissonis*. Only a very shallow bracteal cavity is developed. The "saddle" of the special swimming-bell* or surface that articulates with the sutural surface is nearly vertical, instead of horizontal as it is in *D. dispar*. The ends of the phyllocyst grow out horizontally into horns, neither of which appears to be strictly homologous with the upstanding somatocyst of *D. dispar*. The bract is, in fact, one of the most primitive.



TEXT-FIG. 22.—*Diphyes bojani* (Eschscholtz). × 16. Lateral view of the eudoxid, to show the thin, shield-shaped bract.

The mature gonophore has a cylindrical peduncle which is set on at an angle towards its right ventral side. No ridges are visible, but there are small vestiges of dorsal teeth, and a small elliptical mouth-plate can generally be seen. There are four straight radial canals, and the manubrium, which carries six or seven eggs in the female, nearly fills the umbrella cavity. The right dorsal and left ventral ridges of the special swimming-bell lie in a plane which cuts the flattened bract at right angles, while the other two ridges lie in a plane parallel with that of the bract. The radial canals do not meet in a point, as noted by Chun (1892) and Moser (1925); the junction of the dorsal canals is at some little distance from the origin of the right ventral canal, and this again is slightly separated from the origin of the left ventral, the upper part of which is curved parallel to the margin of the hydroecium. The nectocalyx is asymmetrical, having an enlargement in the middle of the left side.

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* Bigelow (1911*b*) agrees with Lens and van Riemsdijk in denying the presence of a special nectophore.

Eschscholtz's (1825) fig. 15, pl. 5, and (1829) fig. i, pl. 12, undoubtedly represent a specimen of this species, and serve as a useful criterion as to the accuracy of his figures, for the bract is drawn much too small, the spiral twist of the swimming-bell is not indicated, and the large undivided mouth-plate is shown divided. With the aid of binocular microscopes to-day, it is of course possible to examine and draw such complex structures more easily.

Huxley (1859) gave a good figure of the phyllocyst, feeding polyp and male gonophore *in sitû*, but his fig. 7 of the complete eudoxid gives an erroneous idea of it. The bract is shown as being set on to the bell at a curious angle, the large right dorsal ridge, which would be visible in the position shown, is not indicated, and the undivided mouth-plate, which would be visible "*en face*," is shown as divided.

Chun (1892) gave some lithographed figures of the whole eudoxid and of details, but whilst the artistic technique is admirable, the details are mostly inaccurate. In the figures of the whole eudoxid on his plate viii, the asymmetrical shape of the nectosac is not shown. In his fig. 4 the mouth of the swimming-bell is shown as not twisted far enough round relatively to the bract, although his fig. 5 shows the normal condition.

If Mayer's (1900) fig. 118 represents this eudoxid the bract is badly drawn, and what appears to be a male gonophore is labelled female. I have never seen male and female gonophores present in one and the same eudoxid. The drawing of the apex of the nectosac and the origin of the canals does not represent the usual condition. The apex of the sac extends up to the level of the phyllocyst and beyond the junction of the pedicular canal. His fig. 100 of *Diphyopsis hispaniana* will not convince anyone who is familiar with the eudoxid of *D. bojani*, but it probably represents this species; and the same criticisms apply to this figure that I have just made upon Chun's figure of *Ersaea picta*. The mouth-plate is drawn as divided—almost certainly in error. Bigelow (1911*b*) has given good figures. The homology of the bract with those of other eudoxids would have been made more clear by indicating the extent of the bracteal cavity. When the eudoxid is viewed so that the bract is seen in profile, as in his fig. 7, the twist of the bell is such as to bring the centre of the dorsal edge of the mouth more nearly in line with the centre of the mouth-plate. The drawing of the apex of the sac and the run of the canals does not show the normal state of affairs. The concavity of the nectosac in the region of the hydroecium is not indicated. When the eudoxid is viewed from the dorsal side of the bract, as in his fig. 8, the left edge of the mouth-plate would hardly cover the right dorsal tooth, and the diverticulum of the left side of the nectosac would be visible. The bract is often proportionately wider than the one figured by Bigelow.

Retia mirabilia are to be found at the velar ends of all four subumbral canals of the anterior nectophore, as in the related species *D. dispar* and *D. chamissonis*. The whole length of the ventral canal forms such a "Gefässplatte."

Diphyes chamissonis, Huxley, 1859.

With the exception of *Lensia subtiloides* this was the most abundant species inside the Barrier, and was taken both in the eudoxid and polygastric stages throughout the year. It occurred at three of the six outside stations in very small numbers, and was present at all the seven intermediate stations in some quantities, but never in such great abundance as that in which it appeared at the inside stations, three miles East of Low Isles.

This species, perhaps one of the lesser known Diphyids, was found originally in numbers during the voyage of H.M.S. "Rattlesnake" in the ship channel within the Barrier and in the Louisiade Archipelago (Huxley, 1859). Subsequent records are: Seychelles (Moser, 1925); Islands between Seychelles, Mauritius and Chagos (Browne, 1926); Maldives (Browne, 1904); Okhamandel Coast, W. India (Browne, 1926); Sumatra (Moser, 1925); Islands of Malay Archipelago (Lens and v. Riemsdijk, 1908); New Guinea (Moser, 1925; Lens and v. Riemsdijk, 1908); Sulu Archipelago (Lens and v. Riemsdijk, 1908); Phillippine Islands (Bigelow, 1919), and Japan (Moser, 1925). An additional record not hitherto published is off Noumea, New Caledonia, where numerous specimens of polygastric and eudoxid stages were taken on 8th and 9th August, 1895, at the surface in daylight, in water of a temperature of 71° F., by H.M.S. "Katoomba," Capt. J. E. Merryon, R.N. Four hundred and sixty eudoxids were taken in one of the surface hauls at 5 p.m.

Lens and Van Riemsdijk (1908) stated that in many specimens of their *D. weberi*, which is a synonym, they found a well-developed bud for the future inferior nectophore. Moser (1925) recorded that she could see no sign of either bud or posterior nectophore in the "Gauss" or "Siboga" material of this species. However, Browne (1926) said of this bud in his "Sealark" specimens, "I am able to confirm its presence." In the absence of further description or figure it was hoped that it might be possible to confirm this statement, but none of Browne's specimens showing the bud can now be found.

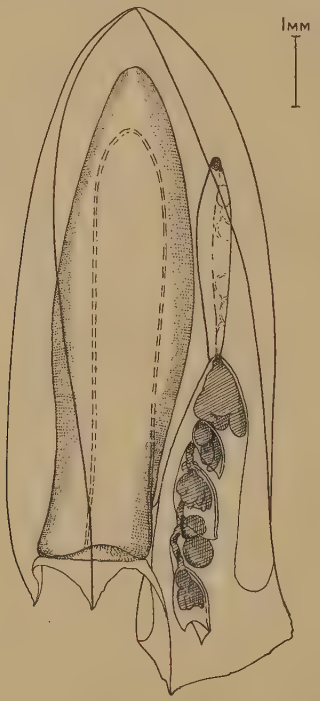
Through the kindness of Dr. L. F. de Beaufort and Dr. H. Engel, of the Zoölogisch Museum, Amsterdam, I was permitted recently to re-examine 91 of the Siboga specimens, namely 29 from St. 109, 33 from St. 117*a*, and 29 from St. 165. In none of them could I see any sign of a bud for an inferior nectophore. Moreover, there is no sign whatever in any of the innumerable Barrier Reef specimens that I have examined either of a posterior nectophore or of a bud.

A point of interest that does not appear to have been recorded about this species is that in it, as well as in the related *D. dispar* and *D. bojani*, is to be found a *rete mirabile* or "Gefässplatte" at the velar end of each of the four subumbral canals. That of the ventral canal extends the whole way from the circular canal to the peduncular canal, and the laterals are given off from its forward side. The others are smaller.

Although there are no specimens in this collection of the most primitive member of the genus, *D. antarctica*, it may be useful to point out in this place that in that species the "Gefässplatte" is found in its least specialized form. Other primitive features of that isolated species are the still divided mouth-plate, and the fact that the unspecialized swimming-bell of the eudoxid still functions as a gonophore.

The polygastric stage of *D. chamissonis* (Text-fig. 29) has been figured by Huxley (1859), Browne (1904), Lens and Van Riemsdijk (1908), and Moser (1925), who also figured the eudoxids. In addition Bigelow (1913, 1919) and Browne (1926) have added to our knowledge of the species.

Moser's figure represents a young specimen 2 mm. in length, viewed from the left side. It illustrates the curved dorsal ridge or keel at that stage. In mature specimens the keel is straighter at the after end, as in Browne's figure. The ventral wall of the nectosac in Moser's specimen appears to have collapsed. Browne has figured this wall accurately. At the after end is the horizontal " Gefässplatte." In front of the point where the peduncular canal joins this, the wall swells out abruptly to form a gentle curve towards the apex. Huxley, Moser, and Lens and Van Riemsdijk have figured the twisted left lateral ridge. That on the other side, figured by Browne, is straight. None of the figures except Lens and Van Riemsdijk's show the twisted ventral facet, the forepart of which can be seen from the left side. Lens and Van Riemsdijk indicate this, but in their figure the after part of the facet does not return to the horizontal as it should. The after end of the right ventral ridge in their figure should be hidden by the end of the left ventral ridge. In Browne's figure the oral teeth and mouth-plate are abnormally short. The mouth-plate, which is seen in optical section in a side view, is five-sixths the diameter of the nectosac at its oral end. Browne's figured specimen is narrower than the majority that I have examined. The dorsal side of the somatocyst and hydroecium are in line, as shown by Browne, but the ventral sides meet at an angle as shown by Huxley, Lens and Van Riemsdijk and Moser.

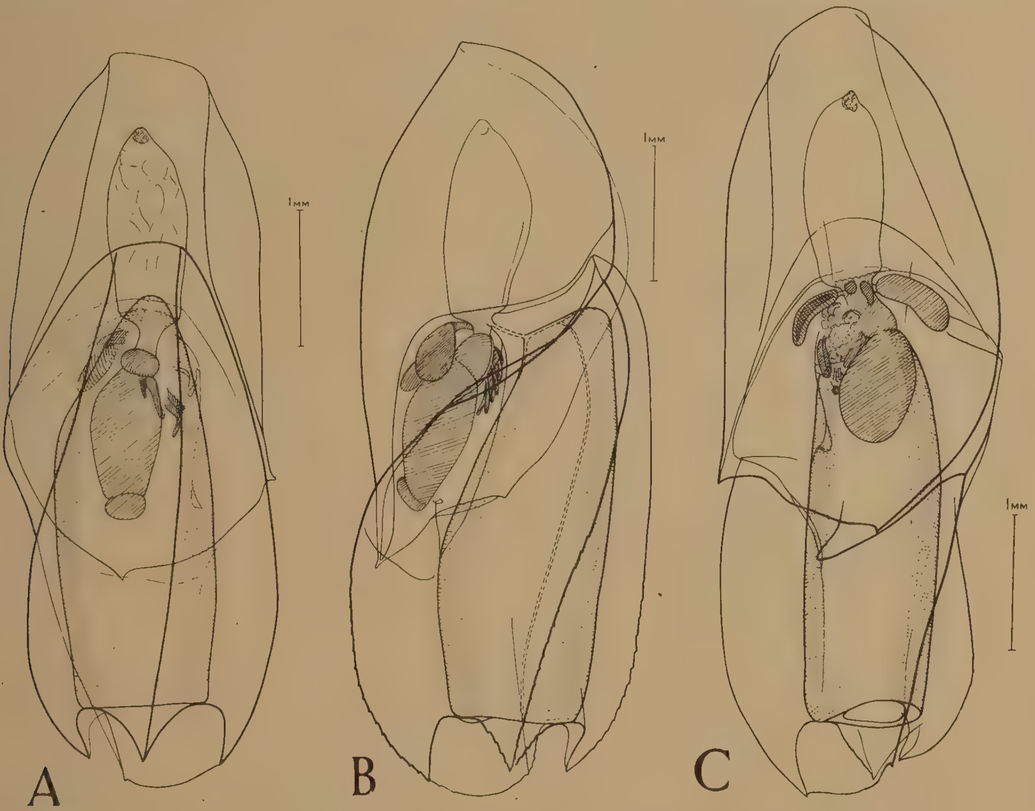


Text-fig. 23.—*Diphyes chamissonis*, Huxley. ×10·5. Lateral view of the solitary (anterior) nectophore, to show the asymmetrical twist of the ventral facet.

The eudoxid (Text-fig. 24) was recorded for the first time, very briefly described, and rather inadequately figured by Moser (1925), and more fully described by Browne in the following year.

The two *Diphyes* eudoxids with normal bracts and special swimming-bells, *D. dispar* and *D. chamissonis*, can at once be distinguished by details of bract and bell, and by the way in which the two articulate.

Browne (1926) has commented on the difference in the shapes of the sutural surfaces. The plane of articulation between bract and bell in *D. dispar* is at right angles to the axial line, in *D. chamissonis* at 45°. In *D. bojani* it is almost parallel with it. When the bract of *D. chamissonis* is viewed from the right or left side it will be seen that the lengths of head-piece and neck-shield are about equal. In *D. dispar* the head-piece is 50% larger. In *D. chamissonis* the dorsal wall of the head-piece is more convex. Owing to the forward extension of the articulating areas of bract and bell, the after-part of the sutural surface is more cut away and rounded off, so that this side, too, is convex. The apex of the head-piece is therefore much less pointed than in *D. dispar*, in which the dorsal and sutural surfaces are nearly straight, and meet at an acute angle.



TEXT-FIG. 24.—*Diphyes chamissonis*, Huxley. × 20. A, Ventral; B, lateral; C, dorsal view of bract. The appendages are shown semi-diagrammatically.

In *D. chamissonis* the apical wall of the nectosac of the eudoxid bell is longer than in *D. dispar* and inclined at an angle to the axis, whereas in *D. dispar* it is very short and at right angles to the axis. The pedicular canal in *D. chamissonis* is very short in comparison with *D. dispar*, being shorter than the apical wall. The ventral teeth of the special swimming-bell are connected by a convex plate which projects beyond them. The hydroecial cavity of the bract in *D. chamissonis* is shallow, and the tooth on the hydroecial "Leiste" is relatively smaller.

The sexes of eudoxids are separate, six or seven simple sac-like gonophores being produced. The females contain from six to eight eggs. A gonocalyx does not appear to form round the manubrium of the gonophore, as pointed out by Browne.

The reasons for assigning this eudoxid to *D. chamissonis* are the association between the eudoxid and the polygastric stage of that species, noted by Moser (1925) and Browne (1926), in the absence of other possibly related species, the similar association of stages from New Caledonia recorded above, and the special abundance of both stages at all times of the year near Low Isles, when other species were less abundant or absent.

Only four Diphyid larvae have been picked out from the various hauls. They measure from 0·7 mm. to 0·8 mm. in length, and from 0·4 mm. to 0·5 mm. in diameter, but are as yet without the rudiment of the future anterior nectophore. Three of them came from the weekly station three miles East of Low Islands in oblique hauls of the fine tow-net from 32 metres to the surface in January, at a time when no other diphyids but *D. chamissonis* were taken, so that they probably belong to this species. One other larva was taken in a closing net at 8 m. from the surface at the weekly station in October, at a time when other diphyids were also taken, so that it cannot definitely be assigned to this species. The larvae are conical in shape, the cylindrical broad-topped nectosac occupying about half its length. There is a very shallow hydroecial groove bounded below by a small rounded mouth-plate. Viewed from the aboral end the larva appears to be pentagonal in outline. The somatocyst is small, oblique and rudimentary, and a single siphon and tentacle are present. The course of the radial canals cannot be seen, but the pedicular canal joins them on one side instead of at the apex.

Chelophyes, gen. nov.

GENOTYPE.—*Diphyes appendiculata*, Eschscholtz, 1829.

GENERIC DIAGNOSIS.—Baso-dorsal and lateral teeth absent from both nectophores. Posterior nectophore retained, its basal lamella with two strong teeth.

Chelophyes appendiculata (Eschscholtz, 1829).

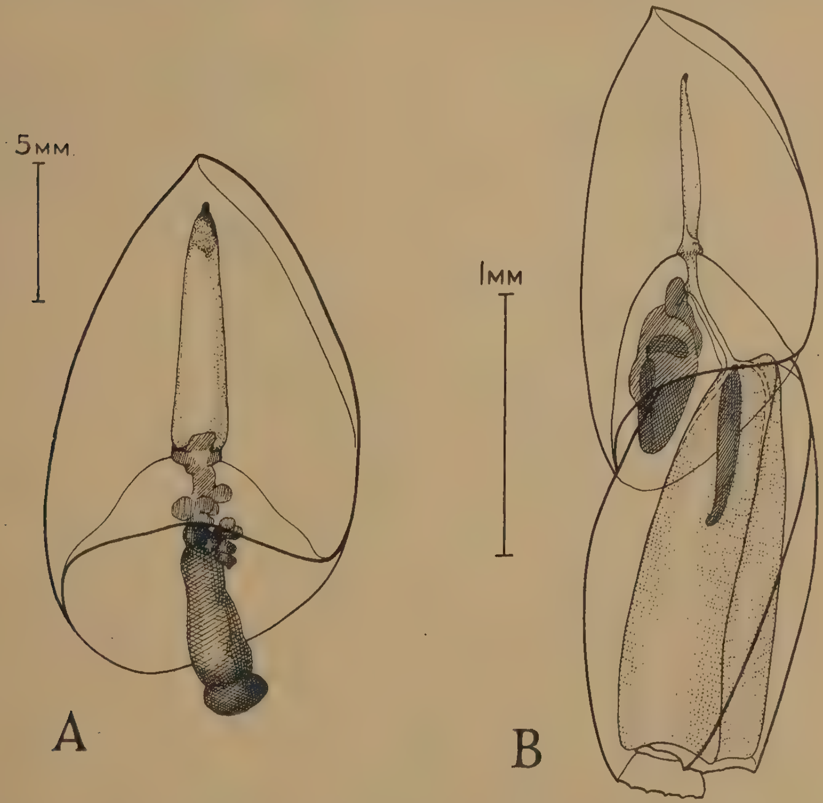
About 150 specimens were taken at both inside, outside and intermediate stations. The species was taken regularly in August, September, October and November, being perhaps most plentiful in September, when 62 of the specimens were taken in five hauls at three stations. It was found again outside on 18th March, and at the weekly station on 7th June. At St. 16 its vertical distribution was as follows :

Depth.	Number of specimens.
3·1 m.	9
8·0 m.	9
11·1 m.	1
12·5 m.	1
16·5 m.	2

It still seems to be doubtful which, if any, eudoxid is budded off by this species. In the 1-metre coarse silk tow-net haul at St. 19 were taken 4 complete specimens, 33 loose bracts, and 60 loose gonophores of a small eudoxid (Text-figs. 33–36), with neither special swimming-bell nor mouth-teeth, but with a rounded mouth-plate to its gonophores, and a pronounced bracteal cavity. They agree pretty well with Moser's descriptions and figure of *E. campanula* (1925, pl. xii), said to belong to *D. appendiculata*, but which, on account of its size and characters, appears to be more like a *Lensia* eudoxid. It will be convenient to deal with the specimens at this point. I give them the name *Eudoxia russelli*.

"*Eudoxia russelli*," sp. nov.

The bract (Text-fig. 25) resembles that figured by Leuckart (1853) on pl. iii, fig. 18, for his *E. campanula*. There is a deep bracteal cavity, the ventral wall meeting the sutural surface at an angle of 75°. The somatocyst in the better preserved specimens is cylindrical, with a tapered apex, and often an enlargement in the middle. It reaches nearly to the apex of the sutural surface.



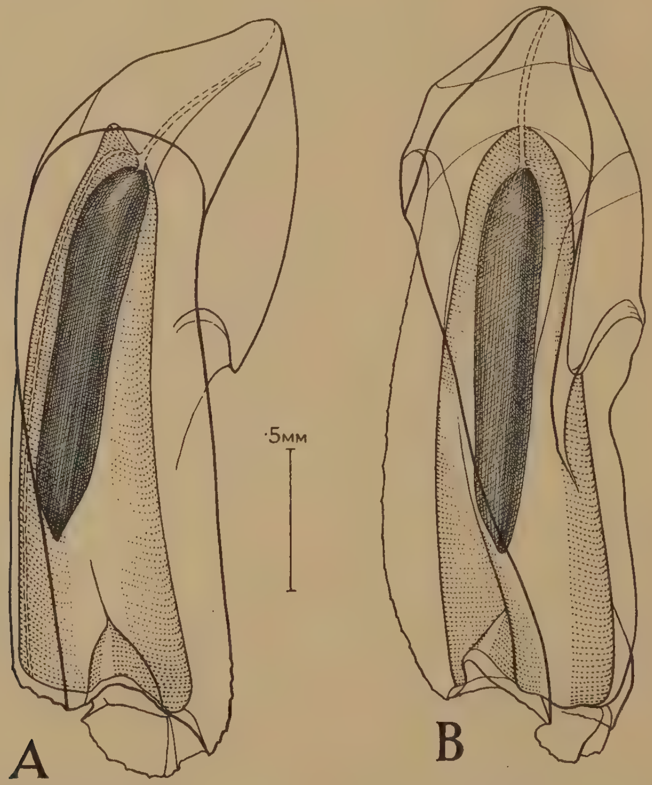
Text-fig. 25.—*Eudoxia russelli*, sp. n. A, Lateral view of bract, × 41; B, lateral view, × 39, of a complete eudoxid, showing the deep bracteal cavity.

The margin of the neck-shield of the bract is evenly rounded, and teeth cannot with certainty be distinguished.

The sutural surface ends posteriorly in a ridge, so that there is no articulation between it and the gonophore, the peduncle of which is completely within the bracteal cavity.

The second gonophore of each eudoxid, the sexes being separate as usual, is the mirror-image of the first.

There is in the middle of the right hydroecial wall (left wall of mirror-image) of the first gonophore an oblique basally projecting spur ridge (Text-fig. 26), dividing the basal from the proximal part of the twisted hydroecium. It sometimes forms a hook. The basal part of the hydroecial wall on that side is not produced into a high ridge, as are the other parts of the walls.



Text-fig. 26.—*Eudoxia russelli*, sp. n. × 42. A, Lateral view; B, ventral view.

The two inconspicuous dorsal ridges, which end in small teeth, are connected at the level of the apex of the nectosac by an arched ridge. The left ventral and left dorsal (right dorsal in mirror-image) of the first gonophore are connected at the same level by a similar ridge. The ventral ridges are connected below by a rounded mouth-plate.

The gonophore's four radial canals lie under the ridges, the two dorsal ones curving over on either side of the pointed apical blind end of the nectosac.

The point in which these eudoxids differ from Leuckart's (1853) *Eudoxia campanula* is in the shape of the gonophore, which he described and figured (fig. 19) in some detail. The mouth-plate of his gonophore was not rounded, but toothed, and the dorsal wall of the nectosac is not S-shaped as figured and described by him.

The eudoxid figured by Moser (1925) on p. 245 has a shallow bracteal cavity, and the gonophore, which is probably deformed, appears to have no apical blind end. It seems to differ both from Leuckart's *E. campanula* and from *E. russelli*. Neither her description nor figure appear to be sufficiently critical for identification.

Moser cites as a synonym for the eudoxid stage of *D. appendiculata* the *Eudoxia messanensis* of Gegenbaur (1854). *E. messanensis* is described as having six longitudinal ridges on the gonophore, there being two lateral ridges which extend for half its length. The two dorsal ridges are described as terminating in teeth, but the two ventral as uniting in a projecting keel-like flap, presumably, and so illustrated, without obvious teeth. In these respects *E. messanensis* differs from *E. campanula*, Leuckart. The free eudoxid figured by Schneider (1896), pl. 45, fig. 30, under the name *D. appendiculata* has a gonophore whose longitudinal ridges do not end in teeth, and the details of which are not very convincingly drawn, so that it would be difficult to recognize it.

Chelophyes contorta (Lens and Van Riemsdijk, 1908).

This species occurred sparingly (specimens estimated at 50 in all) at outside and intermediate stations only, except for a comparatively large catch (estimated at 20) from the inside station 13, where specimens appeared earliest in the year. No intermediate or outside station appears to have been made in January, and no specimens are recorded for that month.

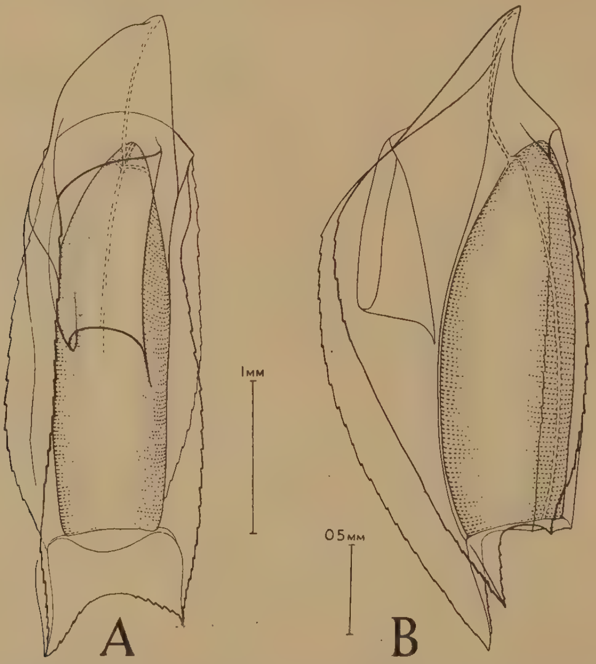
A specimen of this species was first recorded by Bedot (1896), who assigned it to *D. gracilis*, Gegenbaur, 1853. He figured a complete specimen from Amboina and a detached posterior nectophore. Some eudoxids which were associated with the polygastric stages he referred to Gegenbaur's *Eudoxia messanensis* without further description, except to state that they did not differ from the *Eudoxia campanula* of Leuckart. Moser, too, recorded the posterior nectophores of this species, having had for examination a complete specimen from the North coast of New Guinea, and many loose posterior nectophores from various localities. Bigelow (1919), recorded three specimens with buds of inferior nectophores.

One specimen in the Barrier Reef Collection, 5·23 mm. in length, has within the hydroecium a young posterior nectophore measuring 0·85 mm. in length, and at least four other specimens have younger buds. From St. 26, at which these specimens with buds were taken come three loose posterior nectophores, and from St. 19 come four others, the largest of which measures 3·52 mm. × 1·52 mm.

Moser (1925) has already compared the posterior nectophore with that of *D. appendiculata*. In addition to the differences pointed out by her there are others which should be noted. In *D. contorta* the ventral ridges are relatively less deep near the mouth, but wider in the middle region, giving the ventral side a bowed appearance in lateral view. The peduncle is relatively shorter than in *appendiculata*, and the nectosac ends in a pointed blind end. The apical wall is oblique and runs into the dorsal wall without the marked angle that is usually seen in *appendiculata*, but this is not a constant character in that species. Moser's statement that Bedot's figure makes the length of the ventral teeth too much alike is confirmed by my observation that the right-hand tooth is the shorter in these specimens. The arrangement of the canals is similar to that found in *appendiculata*, the dorsal and ventral median and two laterals being given off by the pedicular at a little distance from the apex.

The only eudoxids so far recorded as attributable to this species are those found at Amboina, and referred by Bedot (1896) to Gegenbaur's *E. messanensis.* The present material has provided no evidence on this point.

Lens and Van Riemsdijk's original description is worded badly, but Bigelow (1919) seems to have made a slip in alleging that they stated that there were five ridges at the apex.* They described and figured three in their fig. 49. Bigelow himself (1911*b*, pl. 8, fig. 3) figured correctly only three ridges meeting at the apex, and evidently made a second slip in stating (1919) that there were four. The left ventral and dorsal ridges do not reach the apex in the Great Barrier Reef specimens.



TEXT-FIG. 27.—*Chelophyes contorta* (Lens and Van Riemsdijk). × 25. A, Ventral view of posterior nectophore to show the right hydroecial fold; B, lateral view of the same nectophore.

Eudoxoides, Huxley, 1859.

GENOTYPE.—*Diphyes mitra,* Huxley, 1859.

Eudoxoides mitra (Huxley, 1859).

Syn.: *Eudoxoides sagittata,* Huxley, 1859.

Sixteen specimens of the polygastric and fifteen of the eudoxid stage were taken. Outside stations were made only in October, November, February and March. The species occurred at all except the February one, and also at an intermediate one in Trinity Opening on 19th November. But it was taken only four times at the weekly station, three miles E. of Low Isles, on 11th and 20th September, 3rd October, and 27th December.

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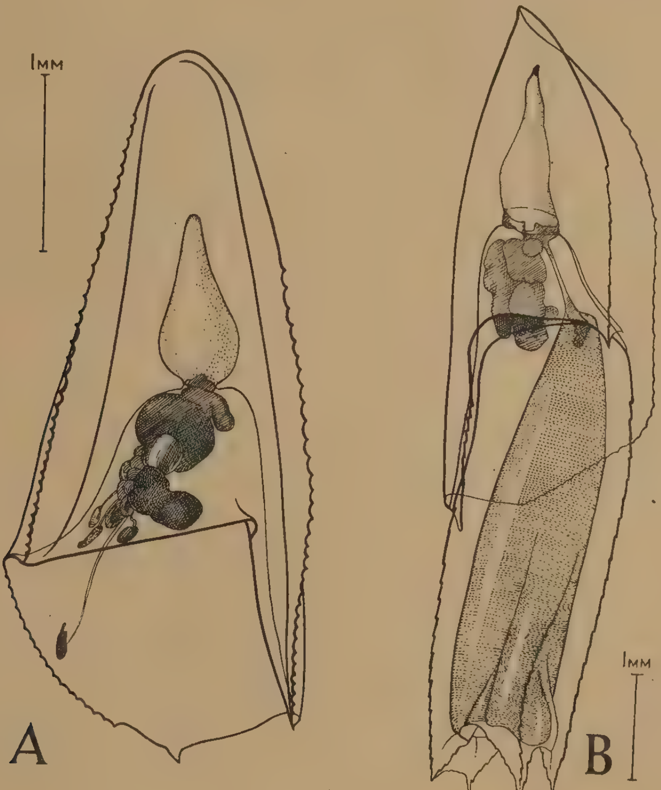
* Bigelow (1911*b*) alleged that the authors of the species stated that there were four ridges at the apex.

The bract of the eudoxid was well figured from two view-points by Huxley (1859). Bracts of mature eudoxids are often broader in proportion to length than shown by him. The edge of the posterior embayment is not generally so strongly toothed, and the posterior right marginal tooth does not extend so far behind as is shown in his upper view, fig. 1. The left sutural ridge curves off broadly at the hinder end of the bracteal cavity to meet the posterior embayment, and does not form the angle shown in his lower figure. Huxley did not indicate the serration of the posterior parts of the sutural ridges of the bract in his lower view, and emphasized it too much in his upper view.



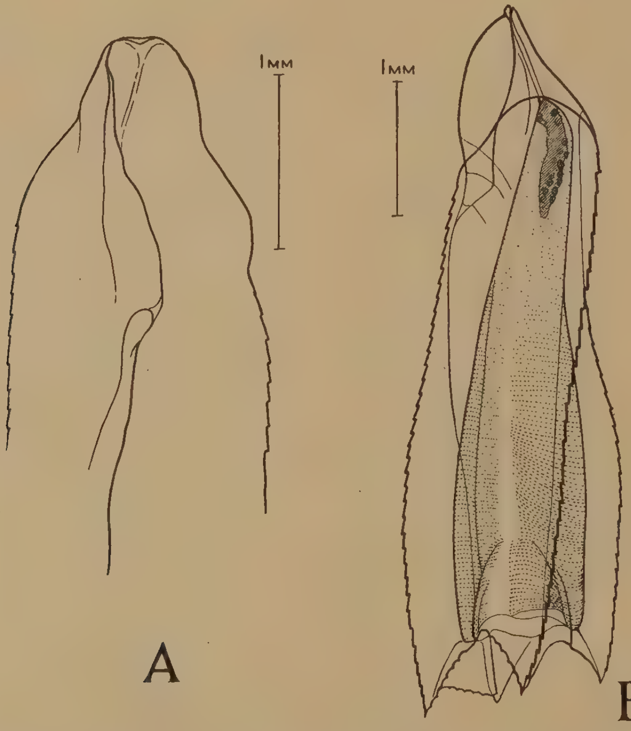
TEXT-FIG. 28.—*Eudoxoides mitra* (Huxley). A, Ventral view of the bract of the eudoxid, × 26; B, lateral view of a complete eudoxid, × 16.

Lens and Van Riemsdijk's figure of the eudoxid (1908, pl. vii, fig. 62) is good. They have drawn a specimen whose bract has an abnormally recurved tip and an abnormally squat somatocyst, but they indicate the correct amount of twist in the gonophore.

Bigelow's (1911*b*) fig. 9 of plate 11 is a good representation of this eudoxid, but the bract as drawn is unnaturally twisted round relatively to the gonophore. When the gonophore is viewed from that direction the sutural surface of the bract is seen edge on.

The bract usually extends further down the gonophore than is shown. Moser's fig. 11 of the whole eudoxid is good. In her fig. 7 the contour of the posterior part of the bract is not good.

The nectosac of the gonophore (Text-fig. 29B) is quadrangular, and the radial canals lie on the corners under the ridges. At the level of the apex of the nectosac there are low rounded ridges connecting the right dorsal and right ventral ridges, and right and left dorsal ridges. These connecting ridges mark the contact with the bract, that on the dorsal side lying at the oral margin of the sutural surface. The area proximal to these connecting ridges is the apophysis or peduncle. It is convexly rounded on the dorsal side, where it fits into the bracteal cavity and slopes off from the connecting ridges to its apex. On its ventral side (Text-fig. 29A) it is concave in section, and is continuous with the proximal parts of the two ventral expanded ridges that form the hydroecium.



Text-fig. 29.—*Eudoxoides mitra* (Huxley). A, Ventro-lateral view of the apex of a gonophore, × 26, to show left hydroecial fold; B, view of right side of a female gonophore of a eudoxid, × 20.

Eudoxoides spiralis (Bigelow, 1911*b*).

Material.—Specimens of the polygastric stage appeared sparingly between 17th August and 18th March, 1928, at both deep water stations and inside the Barrier, as well as intermediately as follows :

Station number.	Depth from which an open net was fished to surface.
6	32 m.
8	45 m.
10, 12, 14, 15, 18	32 m.
19	180 m.
20	250 m.
26	57 m.
28	580 m.
34	32 m.
49	46 m.
50	400 m.

The total number taken at these stations was estimated at 168. It is quite possible that *E. spiralis* was taken at other stations, but that it has been overlooked. Very few eudoxids were noticed in these catches.

At St. 16, where a closing net was fished at six depths between 10.13 a.m. and 12.27 p.m., specimens of *E. spiralis* occurred in the catches as follows :

	Surface.	3·1 m.	8 m.	11·1 m.	12·5 m.	16·5 m.
Polygastric stage	0	6	10	0	0	1
Eudoxid stage	1	2	5	2	0	21

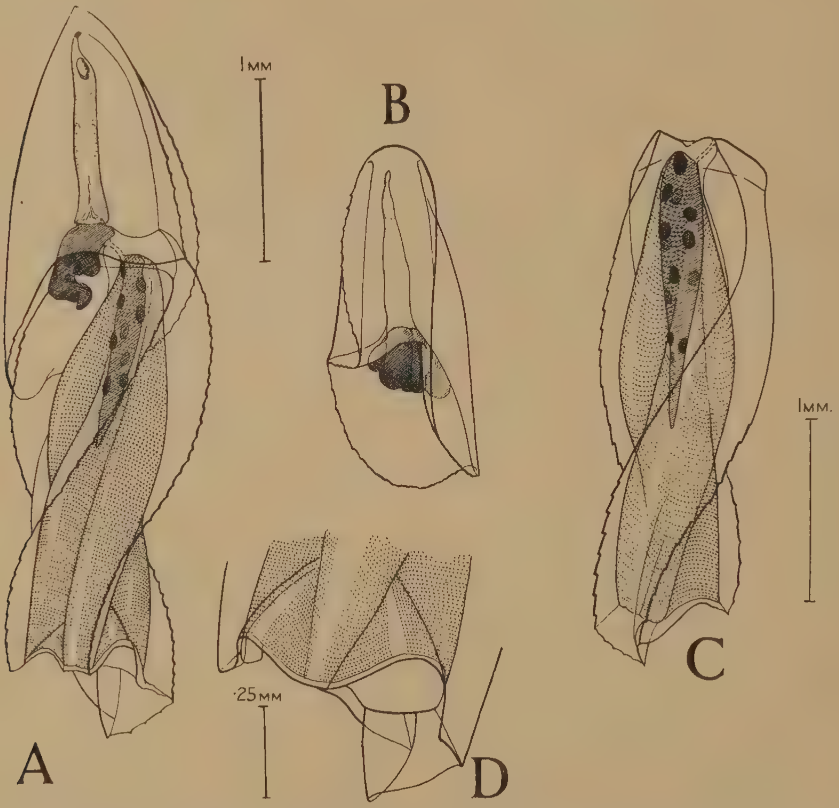
In the catches from the eighteen hauls of closing nets fished at Sts. 62, 65 and 68 on 15th June, 10th and 18th July, 1929, respectively, a single specimen of the polygastric stage was found. It came from a depth of 50 m. at about midday. There is evidence, then, that the polygastric stage extends in daylight from 3 to 50 m. from the surface, and the eudoxid from the surface down to 17 metres ; but there is no evidence that these are the limits of its vertical distribution in daylight in the Barrier Reef region ; indeed, five specimens were taken in the Bottom Stramin Plankton net which was fished on the bottom at 205 m. at St. 29 on 24th November, but they may have been taken anywhere between the bottom and the surface.

Browne (1926) records the capture of this species in the Indian Ocean by self-closing nets as follows :

457–914 m.	1 eudoxid.
At 914 m.	1 anterior nectophore.

He did not state whether or not the hauls were made in daylight.

The eudoxid (Text-fig. 30A) has been figured by Moser (1925), who so far has given us the only account of it. Her fig. 8, pl. 1, will be found to show the mirror-image of the bract figured immediately above it in fig. 9. In no species have I observed such enantiomorphism of the bract. The bracts of eudoxids appear to be always of one kind. As this question is not mentioned in the text, the drawing of fig. 8 may be an artist's error. The gonophores, presumably first and second respectively, are mirror images of one another as in *Diphyes dispar* and *E. mitra*. The details of Moser's fig. 9 do not correspond very closely with those of the present specimens, although the eudoxids of this species are peculiar enough to be instantly recognizable. The dorsal and left sides of the neck-shield (Text-fig. 30B) are at right angles to one another, with a rounded instead of a pointed embayment between them. The dorsal half projects as a rule further aft than that of the left side, and the right-hand side is more cut away posteriorly than in the one figured by Moser. The whole neck-shield is rather larger in proportion than she has represented it to be.



Text-fig. 30.—*Eudoxoides spiralis* (Bigelow). A, Lateral view of a complete eudoxid, × 27, to show the twisted gonophore; B, ventral view of a bract of a eudoxid, × 27, to show the absence of large teeth on the edge of the neck-shield; C, lateral view of a detached female gonophore, × 27, to show the very short pedicel; D, enlarged view of the base of the gonophore shown in A, × 54.

The gonophores (Text-fig. 30C) are spirally twisted rather more than one quarter of a turn to the left or right, according to the order of appearance, presumably. The pedicular canal is very short, and there is no apparent peduncle, the two walls of the hydroecium arching inwards towards the apex of the nectosac, and over to meet each other. Between this point and the dorsal side, where the two dorsal ridges are connected by a flat asymmetrical arched ridge, there is a slightly depressed "saddle-area" which articulates with the bract. On the right side* of the first gonophore a low arched ridge connects the tops of the dorsal and ventral ridges. The right dorsal and right ventral corners of the upper truncated surface of the gonophore are sloped off to the respective longitudinal ridges. On the left side there is a very slightly marked ridge separating the saddle-area from the concave left side of the gonophore. The ventral longitudinal ridges which form the hydroecial walls broaden gradually in the promixal third of their length. The right-hand one is interrupted as a rule at a third of its length from the truncated apex by the vestige of an obliquely descending projection, which in other species forms a hydroecial tooth. At this level is often observed a line or crease running across the outside of the left hydroecial wall of the gonophore. The distal extremities of the ventral ridges are connected by a semicircular mouth-plate.

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* The terms "right" and "left" are interchangeable according to whether the gonophore referred to is the first or second.

Live polygastric specimens examined by me in March, 1931, in the Bay of Algeciras were found to be relatively very rapid " darters " that took an open spiral course. In their habits they are strongly contrasted with specimens of such slowly moving species as *A. tetragona*.

Dimophyes, Moser, 1925.

Genotype.—*Diphyes arctica*, Chun, 1897.

Moser's generic name may be used conveniently for Chun's species, whose systematic position was left out of the discussion on p. 345.

Dimophyes arctica (Chun, 1897).

One eudoxid, 3·6 mm. in length, of this species was taken at St. 28, outside Trinity Opening on 23rd November, in a vertical haul from 580 m.

The eudoxid of this species is easily recognized by its long neck-shield containing a descending branch of the phyllocyst, which also gives off an apical branch. There are no marked ridges or mouth teeth, but a very inconspicuous shallow rounded mouth-plate is present.

This species has a very much wider distribution than was supposed some years ago. It occurs in both the Arctic and Antarctic, being particularly common in the subantarctic; throughout the Atlantic; in the Indian Ocean (Port Natal, Moser); between Providence and Alphonse Is. (Browne, 1926); in Sagami Bay, Japan (Moser); and in the Northern Pacific (Bigelow, 1913). The present record from the Barrier Reef therefore helps to fill in a large gap.

Genus *Lensia*,* gen. nov.

Genotype.—*Diphyes subtiloides*, Lens and van Riemsdjik, 1908, p. 46, pl. vii, figs. 59–61.

Small diphyid Calycophorae, with pentagonal anterior and smaller fragile posterior nectophores. The anterior nectophore has a very shallow hydroecium, a short and divided mouth-plate and no dorsal or lateral teeth. Its radial canals have no commissures, and its somatocyst is short or of medium length.

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* Not to be confused with *Lenzia*, Kieffer, ' Ann. Soc. Sci. Bruxelles,' XLI, p. 360, 1922. My colleague, Dr. F. W. Edwards, tells me that *Lenzia*, Kieffer, is sunk in the synonymy of *Phaenopsectra*, Kieffer, 1921 (*Chironomidae*).

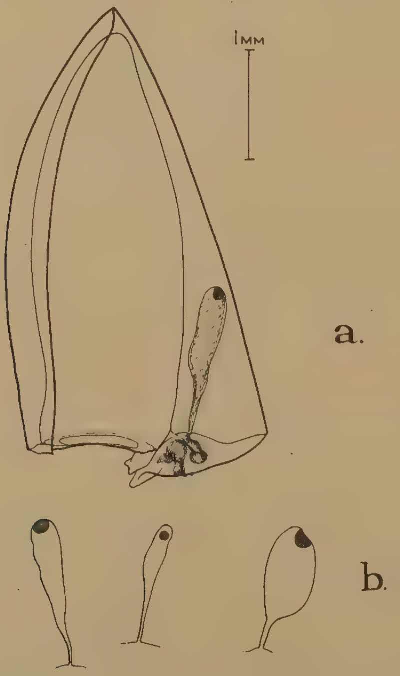
The posterior nectophore is truncated anteriorly, has a rounded mouth-plate and no teeth. The lateral radial canals are not looped.

The eudoxid has no special swimming-bell. Its bract has a broad rounded posterior edge without teeth, and its gonophores are truncated anteriorly, with small dorsal teeth, and with narrow rounded mouth-plate.

Very numerous specimens that correspond closely with Lens and Van Riemsdijk's *Diphyes subtiloides* occur in most of the catches inside the Barrier Reef. Some of them have a mature fragile posterior nectophore. It appears to be desirable to associate in a separate genus this *Diphyes subtiloides* of Lens and Van Riemsdijk with three other small Diphyids—*Diphyes subtilis*, Chun, 1886, *D. fowleri*, Bigelow, 1911, and *D. truncata*, Sars. With them may be included some so-called *Galeolaria* species—*G. campanella*, Moser, and *G. multicristata*, Moser. This authority had included *D. subtiloides*, Lens and Van Riemsdijk, and *D. fowleri*, Bigelow, in the synonymy of *G. truncata*. I have examined thousands of specimens of *D. subtiloides*, numerous specimens of *G. truncata* from Hjeltefjord, near Bergen, as well as the type and seven paratypes of *D. fowleri* in the Museum, and ten more kindly lent by Dr. Bigelow. There is nothing approaching transition from one of these species to another, and I recognize the three species as distinct.

Lensia subtiloides (Lens and Van Riemsdijk, 1908).

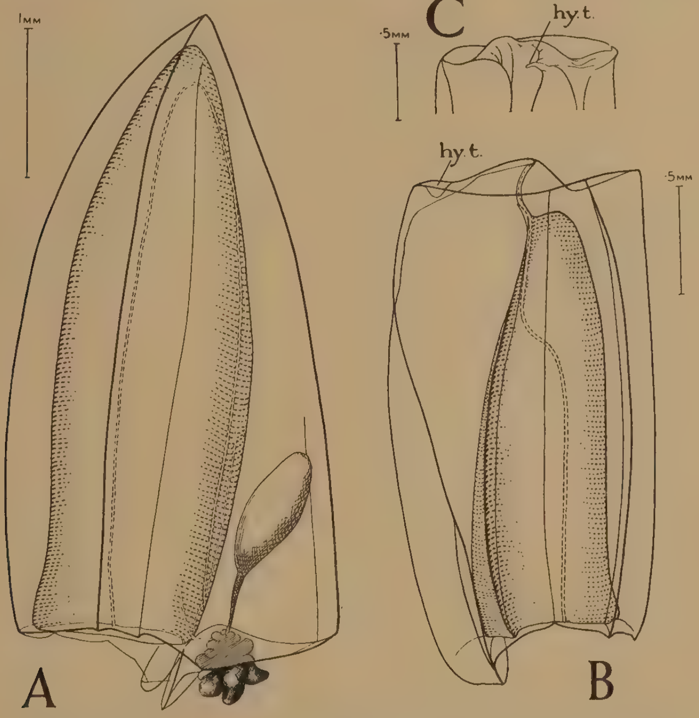
Occurrence.—This was perhaps the most abundant species, nearly 1300 specimens of the polygastric stage having been taken at St. 16 alone, where its vertical distribution



Text-fig. 31.—*Lensia subtiloides* (Lens and Van Riemsdijk). × 16. *a*, Anterior nectophore; *b*, three separate somatocysts, to illustrate the range in variation in the shape of that organ.

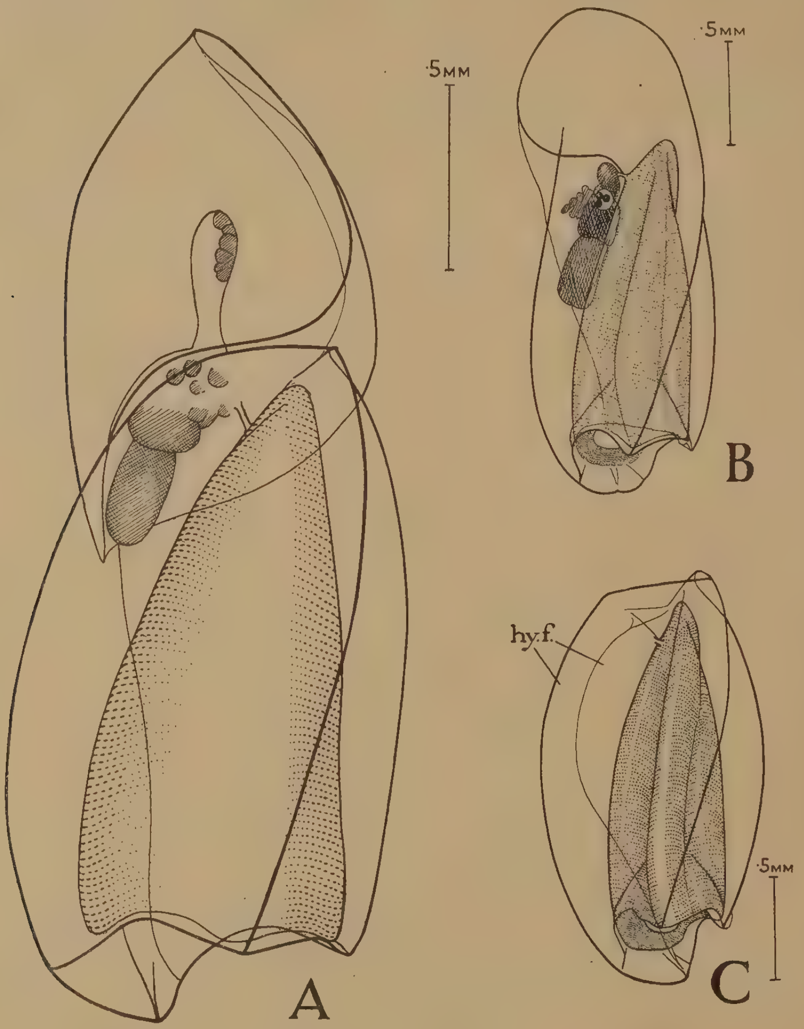
was studied. Here the bulk of the specimens were at a depth of 8 metres in the daytime, many more being taken between that depth and 12·5 metres. The time of its greatest abundance seems to have been from the beginning of December to the middle of February. It was absent from two intermediate stations at the end of February ; also from the weekly station on nine occasions between April and July, and on seven occasions in August and September.

Description.—The resemblance between the very numerous specimens and Lens and Van Riemsdijk's description and fig. 59 is so close as to make it certain that we are dealing with their species. The larger anterior nectophores are from 4·5 mm. to 5 mm. long and 2 mm. deep. The smallest anterior nectophore is 0·62 mm. in length and 0·37 mm. in depth. The specimens vary very little in the shape of the somatocyst (Text-fig. 31). This differs slightly from that figured by Lens and Van Riemsdijk. The summit of the very shallow hydroecium of the anterior nectophore is level with the mouth of the nectophore. The distance between the base of the somatocyst and the mouth-plate is about half that between it and the ventral wall. The peduncle of the somatocyst which arises from this point may be distinguished as a fine canal for a distance of between one-fourth and one-half the length of the somatocyst before gradually passing into it. The anterior end of the somatocyst is rounded, and lies near the ventral wall, the axis of the somatocyst being inclined towards that side from its base, which with its peduncle lies nearer the



Text-fig. 32.—*Lensia subtiloides* (Lens and Van Riemsdijk). A, Anterior nectophore, × 22 ; B, posterior nectophore, × 32, to show the course of the lateral radial canal, and the tooth *hy. t.*, at the apex of the right hydroecial fold ; C, ventral view of the apex of the posterior nectophores, × 23, to show the tooth of the right hydroecial fold.

nectosac. The somatocyst of average specimens varies in length from 0·54 mm. to 0·66 mm., and in diameter from 0·23 mm. to 0·28 mm. The course of the subumbral canals was not observed by lens and Van Riemsdijk. In a Barrier Reef specimen measuring 3·41 mm. in length the lateral canals run up, without any cross connection with the ventral canal, to within a distance of 0·20 mm. of the anterior end of the nectosac, and of 0·37 mm. of the apex of the nectophore, before bending back on a parallel course to meet the ring canal.



Text-fig. 33.—*Lensia subtiloides* (Lens and Van Riemsdijk). A, Lateral view of a complete eudoxid, × 55 ; B, right lateral view of a detached gonophore with enlarged apex, × 31 ; C, similar view of a normal, detached gonophore, to show the hydroecial folds, *hy. f.*

Differentiation.—The anterior nectophore (Text-fig. 32A) is similar in general outline to that of *L. truncata* (Sars), but differs from it in the following ways : The two lobes of the mouth-plate are almost equal in size, whilst in *truncata* the right is the larger. And instead of being flush with the posterior end of the nectophore, as they are in *truncata*, they project posteriorly. The anterior wall of the hydroecium extends forward to the level of the opening of the nectocalyx, which is not the case in *truncata*. Also the somatocyst is relatively shorter and has a longer, though not sharply differentiated pedicel than that of *truncata*, whilst the dorso-basal tooth is relatively smaller. The posterior nectophore (Text-fig. 32B) does not exhibit the diverticulum in the nectocalyx anterior to the entry of the pedicular canal that is characteristic of *truncata*.

The eudoxids (Text-fig. 33A) are similar to those of *truncata*. Mature gonophores are rarely found attached to the bract. In the numerous preserved eudoxids of *truncata* that I have examined only young buds of gonophores were present, although detached mature ones were abundant in the tow-nettings. The bracts of *truncata* eudoxids, like those of *subtiloides*, have no projections on the posterior margin, such as are found in species of *Diphyes*. The two species are very closely related, but quite distinct from one another.

In *Lensia subtilis* (Chun) the fine peduncle is much longer in proportion, and the somatocyst globular.

Lensia subtilis (Chun, 1886).

One complete specimen, twelve anterior and two posterior nectophores in all were taken from three stations outside Trinity Opening, 19, 20 and 28, on 20th October, 19th and 23rd November respectively.

The condition of the material is not such as to enable me to add much to our knowledge of this species. Although the presence of the globular stalked somatocyst is a distinctive character which marks out typical specimens of this species from those of any other that we know at present, the amount of variation in length of this stalk is not known.* There are eight other poor specimens with shorter stalked somatocysts which probably belong to the species, but until this question of variation has been determined in a large series of specimens, it is useless to make a definite assignation of such material.

The species has been recorded from the Mediterranean (common); the Atlantic, from the Bay of Biscay (52°–66° F.) to latitude 35° S.; the Indian Ocean, Madagascar, Rodriguez, Chagos; and off New Guinea (N.E.).

Chun (1886) described but unfortunately did not figure the eudoxids which he raised from the polygastric stage of this species. He said that without doubt they were identical with Will's *Eudoxia elongata*. The fig. xxx, given by Will (1844) is not very easy to interpret, but it appears to show a gonophore without any bract, although Will labelled part of it the "Athemhöhle" or phyllocyst. Chun's judgment, however, cannot be lightly disregarded, since he had active living eudoxids before him; but it is difficult properly to interpret Will's figure, and not possible to substitute his name *elongata* for Chun's, since it was preoccupied by Hyndmann (1841). It should be borne in mind that *subtilis* is a very common Mediterranean species, and that it is very likely that Will did have its eudoxid before him as well as those of the other two species he figured, namely *Muggiaea kochii* and *Sphaeronectes kollikeri*. The gonophores should be easily recognizable by the peculiar canal system described by Chun, but his account does not appear to have received any subsequent confirmation. The eudoxids found by Moser at Villefranche and Monaco and assigned to this species had normal canal systems. There would appear, therefore, to be some doubt as to what the eudoxids of this species are really like.

A characteristic feature is the way in which the furrowed basal facet, or hydroecium, of the anterior nectophore slopes away anteriorly into the ventral facet (Text-fig. 34A). In the posterior nectophore at its anterior end is a projection of the dorsal wall that evidently fits closely into the anterior nectophore at this point. The two nectophores are drawn by Moser in her text-fig. 29 as being very loosely coupled, and with the dorsal side of the posterior and anterior nectophores on one and the same side of the longitudinal axis. I suggest that these are post-mortem phenomena.

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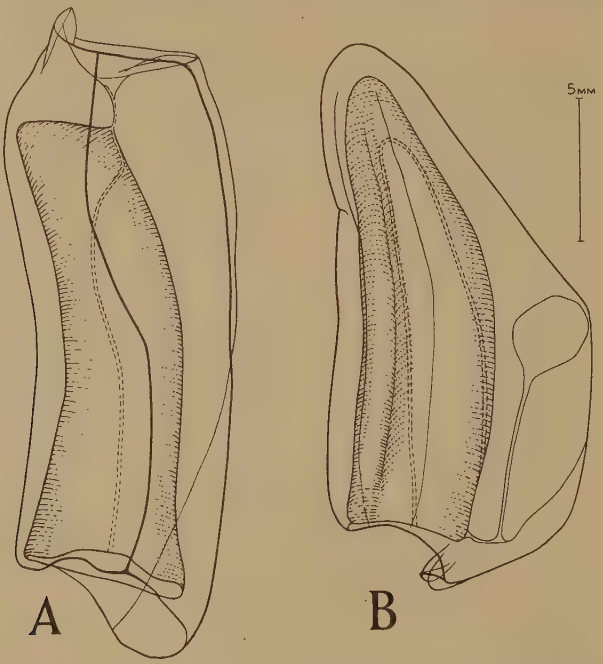
* Lens and Van Riemsdijk (1908) took specimens at Naples every day during January and February, 1906. They reported that in all these specimens the somatocyst had "a long thread stalk."



Text-fig. 34.—*Lensia subtilis* (Chun). × 42. A, Left lateral view of a posterior nectophore, to show the course of the lateral radial canal ; B, left lateral view of an anterior nectophore, to show the hydroecium.

Another feature of this species is the shape of the blind end of the nectosac in the posterior nectophore. There is a considerable anterior wall, which makes nearly a right angle with the dorsal wall.

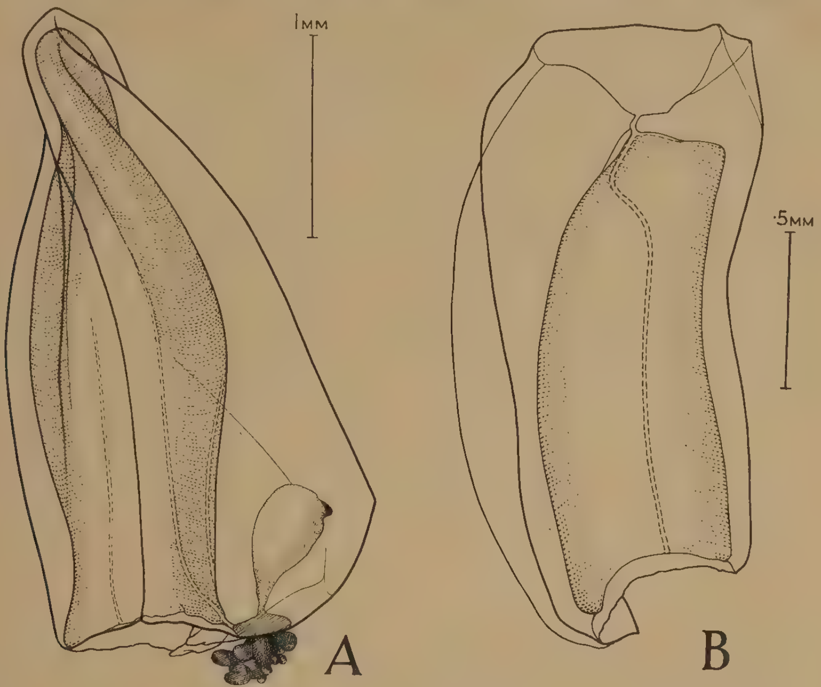
Lensia campanella (Moser, 1925).

One anterior nectophore was taken with the coarse silk net, and three more with a single posterior nectophore in the stramin net at outside St. 19 on 20th October ; one anterior nectophore at intermediate St. 49 on 17th March ; and one anterior nectophore at St. 50 outside Papuan Pass on 18th March, all being taken in vertical hauls of open nets.

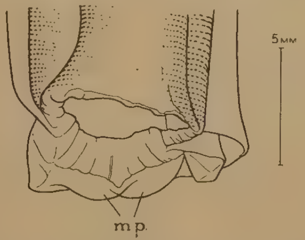
This is a very small species, of which only seven anterior and a single posterior nectophore have been described hitherto. It is said to be cosmopolitan. Previous records are : Tortugas ; W. of Colombo, Ceylon ; and German New Guinea.

The largest anterior nectophore in the collection measures 3·33 mm. in length, and the smallest 1·85 mm.

Both anterior and posterior nectophores (Text-fig. 35) are of the same general build as those of *L. subtiloides* and *L. subtilis*. The mouth-plate is very small indeed and divided (Text-fig. 36), and the longitudinal ridges are scarcely visible. The tip of the nectophore is twisted through nearly half of a complete turn. The small size, the twisting, the well-preserved musculature, the shape of the somatocyst and the oblique sloping off of the ventro-basal facet all point to identity with Moser's species, and yet the longitudinal ridges do not run as shown in her figure. But basing my judgment on my experience of the extent to which Moser's figures correspond with actual specimens, I feel confident that these specimens belong to this species. On account of its great size there appears to be some element of doubt as to whether the large specimen, 11 mm. in length recorded by Moser from W. of Colombo, really belongs to the same species. Unfortunately this is the



Text-fig. 35.—*Lensia campanella* (Moser). A, Left lateral view of an anterior nectophore, × 30, to show the asymmetrical twist; B, right lateral view of a posterior nectophore, × 46, to show the course of the lateral radial canal.



Text-fig. 36.—*Lensia campanella* (Moser). × 35. Ventral view of the base of an anterior nectophore, to show the small size of the mouth-plate, *m.p.*

specimen selected for Moser's figure, pl. iv, fig. 1. I regard the specimens from German New Guinea as the typical forms, and select the larger one taken in 1910 as the holotype. Moser figures a well-marked right lateral ridge in the anterior nectophore. In the Australian specimens it is the right and left ventral ridges and the ventral facet that take part in the twist, the right lateral ridge being practically suppressed. Viewed from the oral end the nectosac appears to be lobed. There is a large ventral lobe, a left lateral and a dorsal. The latter is not in the median line, but balances the left lateral. Towards the apex it can be distinguished as a double lobe, the dorsal predominating in size over the right lateral. In short, viewed from the right side no lateral ridge such as drawn by Moser can be seen, and in this respect the Australian specimens differ from the Colombo one figured by Moser. Viewed from the ventral side the somatocyst is seen to be displaced towards the left ventral ridge. All the ridges are very low, and can only be seen in an oral or apical view. The somatocyst has a very short pedicel, is relatively large and globular or ovoid in shape, and lies obliquely, closely applied to the basal wall of the nectophore.

Whilst collecting in the West Indies in H.M.S. "Rodney" in 1931, I took two specimens of this little-known species off Kingstown, St. Vincent, at the surface at night in February.

Lensia fowleri (Bigelow, 1911).

A single anterior nectophore, 4·8 mm. in length, was taken at St. 28, outside Trinity opening, on 23rd November. The state of preservation is not good, but the specimen was compared directly with types kindly supplied by Dr. Bigelow, and also with *L. truncata* from Norwegian waters.

The somatocyst occupies the position characteristic for *fowleri*, but is shrunken, as it often is in that species. In two respects it agrees very closely with the types and differs from *truncata*. The apex of the nectosac reaches very nearly to the apex of the nectophore; and the dorsal longitudinal ridge is comparatively shallow, and does not project beyond the opening of the nectosac. These two points may escape attention unless specimens of the two species are closely examined side by side. The differences, however, are clear cut, and furnish two more useful characters for the separation of these two species. The lateral ridges at their oral ends slope back in a characteristic way towards the mouth-plate, and the lateral radial canals lie almost directly under the ridges. All of the ridges are rather obtuse-angled.

In *Lensia fowleri* (Bigelow) the somatocyst is nearly globular, and extends down to the posterior end of the nectophore on the ventral side of the hydroecium. Its summit extends well above the level of the mouth of the nectophore, which reaches a much larger size than in *Lensia truncata* and *L. subtiloides*. The figures of the somatocyst and hydroecium of *L. fowleri* given by Bigelow (1911*b*) do not very closely represent the conditions found in the Museum's seven syntypes, and in ten more from the Museum of Comparative Zoology, Cambridge, Mass., kindly loaned by Dr. Bigelow. The hydroecium is confined to a very small space on the dorsal side of the somatocyst. In all cases the somatocyst had partly collapsed, but there was sufficient indication of the space that it originally occupied.

Lensia, spp. indet.

From St. 20, outside Trinity opening, come seven small specimens of a species of *Lensia* from 3 mm. to 4·8 mm. in length. The five longitudinal ridges are distinct.

The somatocyst, which is short, unstalked and oblique, is 0·6 mm. in length in the longest specimen. The dorsal ridge is not so deep as in *G. truncata* from Norwegian waters, and it does not project so far beyond the velar level. Three of the specimens are fairly well preserved, but it is not possible to say definitely whether the lateral ridges reach the level of the velum owing to longitudinal folding of the nectophore walls. The basal plane is oblique to the longitudinal axis owing to the shortness of the ventral wall. The mouth-plate is short, and divided with rounded inner angles. The two lateral canals come off separately at varying levels from the base of the ventral canal. The canal system is normal.

Probably these specimens will prove, later on, to belong to a new species, but since it is not possible to give a sufficiently critical description of it owing to the condition of the specimens, it is not proposed at this time to establish the new species, but to wait until more material becomes available.

Two specimens of what will probably prove later on to be another new species come from St. 50, outside Papuan Pass. Some description of them may be given, although it is not intended thereby to establish the species. The lateral ridges do not reach the velar level, and the dorsal ridge is very shallow. The inner angles of the two flaps of the mouth-plate are but very slightly rounded, and project down further than the outer angles. The somatocyst is about half the length of the nectophore. The hydroecium, which is entirely below the level of the velum, is more extensive than in *G. truncata* from Norwegian waters, and is continued as a very shallow depression on to the lower part of the ventral facet. Thus there is no sharp ventro-basal ridge as in *G. truncata*.

The two specimens, neither of which is in a good state of preservation, measure about 10·5 mm. in length. They closely resemble the specimen figured by Bigelow (1911*b*), plate 12, fig. 2, and called ? *Muggiaea kochii*, but later (1913) referred to as *Diphyes truncata*, Sars. Sars's species, however, judging by specimens kindly provided by the Bergens Museum Biological Station, is quite distinct.

One eudoxid, 1·8 mm. in length, with a rounded bract and short cylindrical upright phyllocyst, together with fourteen gonophores measuring from 1·2 mm. to 3·9 mm. in length, were taken at St. 20, outside Trinity opening on 20th October. They are of the *Lensia* type, and the gonophores correspond with one figured by Moser (1925), pl. iv, fig. 11, as *Eudoxia galathea*. As suggested by her on p. 267, the type of loose gonophore figured can hardly be held to belong to the same species as the complete eudoxids bearing that name, for they have a conspicuous rounded mouth-plate and a very narrow apex. This narrowed blind end of the nectosac projects between the two dorsal canals, and is a constant feature of the Barrier Reef specimens. The gonophores are longitudinally folded, but the mouths of the nectosacs flare wide open. The male manubrium may have a length of nearly as much as one-half of that of the whole, but the female is considerably shorter.

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INDEX

PAGE
Abyla . . . 331
Abylidae . . . 328, 331
Abylinae . . . 331
Abylopsis . . . 331, 333
acaule, Amphicaryon . . . 330
Agalma . . . 320
Agalmidae . . . 320
" Aglaisma " . . . 337, 338
Amphicaryon . . . 330
" Amphiroa " . . . 332, 337, 338
antarctica, Diphyes . . . 346, 351
appendiculata, Chelophyes . . . 354
appendiculata, Diphyes . . . 346, 354, 357
arctica, Dimophyes . . . 363
arctica, Diphyes . . . 347, 363
asymmetrica, Ceratocymba . . . 332
" Athorybia " . . . 320
australis, Galeolaria . . . 341
australis, Galetta . . . 340, 341, 342, 345

bassensis, Bassia . . . 335, 339
Bassia . . . 331, 338, 339
bijuga, Stephanomia . . . 324
biloba, Galeolaria . . . 344

PAGE
biloba, Galetta . . . 340, 344
bojani, Diphyes . . . 345, 349, 353

Calycophorae . . . 327
campanella, Galeolaria, . . . 364
campanella, Lensia . . . 340, 368
campanula, Eudoxia . . . 346, 347, 355, 356, 357
" Ceratocymba " . . . 332, 337, 338
chamissonis, Diphyes . . . 319, 345, 349, 351
Chelophyes . . . 318, 346, 354
Chondrophorae . . . 319
chuni, Galetta . . . 340, 341, 342
clausi, Agalma . . . 320
contorta, Chelophyes . . . 357
contorta, Diphyes . . . 346, 357
Cordagalma . . . 320, 325
cordiformis, Cordagalma . . . 325
Cuboides . . . 328, 335, 337, 338
Cucullus . . . 346
cucullus, Diphyes . . . 347
Cuneolaria . . . 320
" Cymba ". . . . 332, 337, 338
cymbiformis, Praya . . . 329

dentata, Abyla . . . 332, 334

PAGE

Dimophyes . . . 363
Dimophyidae . . . 327
Diphyabyla . . . 331, 332
Diphyes . . . 336, 345, 346, 353
diphyes, Praya . . . 329
Diphyidae . . . 327, 328, 331, 340
Diphyinae . . . 340, 345
Diphyopsis . . . 345, 346
dispar, Amphiroa . . . 332
dispar, Diphyes . . . 345, 346, 353

elegans, Agalma . . . 321, 322
elongata, Eudoxia . . . 367
Enneagonum . . . 318, 328, 335, 345
Epibulia . . . 340
Erenna . . . 326
eschscholtzii, Abylopsis . . . 328, 335, 338
Eudoxella . . . 329
Eudoxia . . . 346, 355
Eudoxoides . . . 318, 346, 358

Forskalia . . . 327
fowleri, Diphyes . . . 364
fowleri, Lensia . . . 340, 370

gaimardi, Ersaea . . . 347
galathea, Eudoxia . . . 371
Galeolaria . . . 340, 341
Galeolarinae . . . 340
Galetta . . . 340, 341, 342, 344
Galettinae . . . 340
Gefässplatte . . . 350, 351, 352
glabra, Vogtia . . . 331
gracilis, Diphyes . . . 357

haeckeli, Abyla . . . 331
haeckeli, Agalma . . . 321
Head-piece . . . 318
Hippopodiidae . . . 327, 330
Hippopodius . . . 330
hippopus, Hippopodius . . . 330
hispaniana, Diphyopsis . . . 350
hubrechti, Diphyabyla . . . 332
Huxleya . . . 329
hyalinum, Enneagonum . . . 327, 335
Hyperiidae . . . 338

kochii, Muggiaea . . . 367
kollikeri, Sphaeronectes . . . 367

Lensia . . . 317, 318, 363
lessoni, Eudoxia . . . 346
lessonii, Eudoxia . . . 347
leuckartii, Abyla . . . 332

maculata, Heteropyramis . . . 347
messanensis, Eudoxia . . . 357, 358
mitra, Diphyes . . . 346, 358
mitra, Eudoxoides . . . 358
monoica, Sulculeolaria . . . 340, 342
Monophyes . . . 328

PAGE

Monophyidae . . . 327, 328
Monophyism . . . 317, 327, 328
Muggiaea . . . 328
Muggiinae . . . 340
multicristata, Galeolaria . . . 364
multicristata, Lensia . . . 340

Neck-shield . . . 318
Nectodroma . . . 329
Nectopyramis . . . 328
Neoteny . . . 328

okenii, Agalma . . . 320, 321

Physophorae . . . 320, 327
picta, Ersaea . . . 350
plicata, Rosacea . . . 329
Praia . . . 329
Praya . . . 329
Prayidae . . . 327, 329

quadrata, Abyla . . . 334
quadridentata, Sulculeolaria . . . 340, 341, 342
quadrivalvis, Sulculeolaria . . . 338, 340, 341, 342
quoyi, Eudoxia . . . 347

Retia mirabilia . . . 350, 351
Rhizophysaliae . . . 319
Rosacea . . . 329
" russelli, Eudoxia " . . . 355

Saddle . . . 348, 349
sagittata, Ceratocymba . . . 332
sagittata, Eudoxoides . . . 358
Sphaeronectes . . . 328
Sphaeronectidae . . . 327, 328
" Sphenoides " . . . 337, 338
spiralis, Diphyes . . . 328, 346
spiralis, Eudoxoides . . . 360
Stephanomia . . . 324
subtilis, Diphyes . . . 364
subtilis, Lensia . . . 340, 367
subtiloides, Diphyes . . . 363, 364
subtiloides, Galetta . . . 317
subtiloides, Lensia . . . 338, 340, 364
Sulculeolaria . . . 318, 340, 341
Suture . . . 318

tergestinum, Halistemma . . . 325
Terminology . . . 318
tetragona, Abylopsis . . . 328, 331, 333, 338
trigona, Abyla . . . 332
truncata, Diphyes . . . 364
truncata, Lensia . . . 340, 366, 370
turgida, Galetta . . . 340, 341, 344, 345

vitreus, Cuboides . . . 327, 335
vogtii, Abyla . . . 335

weberi, Diphyes . . . 351

REPORT ON STOMATOPOD LARVAE, CUMACEA AND CLADOCERA

BY

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WITH TEN TEXT-FIGURES

CONTENTS

PAGE
INTRODUCTION 375
STOMATOPODA 376
  The Classification of Stomatopod Larvae 376
  Key to the Genera of Larval Stomatopoda 377
  The Reference of Larvae to Adult Forms 378
  The Feeding Mechanisms of the Larvae 378
  Systematic Notes 380
CUMACEA 387
  Introduction 387
  List of Stations at which Cumacea were Obtained 387
  Systematic Notes 388
CLADOCERA 395
LIST OF REFERENCES 396
INDEX 398

INTRODUCTION.

The three widely separated groups which form the subject of this report are brought together here as a matter of convenience because each is represented by only a few species.

My thanks are due to Dr. W. T. Calman, F.R.S., of the British Museum, for the opportunity of studying the collections, and also for much helpful advice and encouragement; also to Dr. I. Gordon, of the British Museum, for assistance with the literature of the subject; to Mr. F. S. Russell, who accompanied the Expedition, for information regarding the distribution of the various species in the plankton; and to Mr. F. A. McNeill, of the Australian Museum, who is preparing the report on the adult Stomatopods, for information regarding the distribution of these forms. Finally I must express my thanks to the Director and Trustees of the British Museum for allowing me to carry out the examination of the material in the Museum.

STOMATOPODA.

THE CLASSIFICATION OF STOMATOPOD LARVAE.

The presence in the collection of larvae representative of the majority of the genera of Stomatopoda has rendered possible a consideration of the relations of the generic characters of the larvae to those of the adults. In this connection I have had the opportunity of studying the large collection of larvae in the British Museum.

Our knowledge of the larval Stomatopoda is mainly due to the work of Claus (1872), Brooks (1886), Hansen (1895 and 1926), and Giesbrecht (1910); the last gives a very good account of the earlier work.

The older workers were very impressed by the way in which the *Alima* larvae of *Squilla* differ from the *Erichthus* larvae of the other genera, but Claus (1872) showed that transitional forms occur, and to these he gave the name *Alimerichthus*. Brooks (1886) also held that there was a wide difference between *Alima* and *Erichthus*, and suggested that, when found, the larvae of the new genus *Coronida* would fill the gap (there was then only one species of *Coronida*), but when these larvae were recognized they did not fit into this scheme.

The first attempt to draw up a key to the Stomatopod larvae was made by Bigelow (1895), but unfortunately he based his key on the general appearance of the forms, which is very deceptive, so that it is of little help towards a natural arrangement; moreover he included such groups as *Squillerichthus* and *Alimerichthus*, which, with our present knowledge, cannot be regarded as larval genera.

A great step was made by Hansen (1895), but his methods of identifying the larvae, excellent as they are, result in a misleading arrangement of the genera, with *Alima*, as is usual, separated from the *Erichthus* forms, which then fall into two groups, *Lysiosquilla* and *Coronida* on the one side, and *Gonodactylus*, *Odontodactylus* and *Pseudosquilla* on the other. This arrangement is the result of Hansen's choice of the shape of the three thoracic appendages which follow the raptorial claw* as one of the chief characters.

The relationship of the genera of adult Stomatopoda has always been an intricate problem; an attempt to elucidate the matter was made by Brooks in his "Challenger" report, but later workers have been unable to agree with his conclusions. The introduction of the larval forms into arguments on this subject has, in the past, always resulted in confusing the issue. I have endeavoured to show in a "key" that the larvae fit naturally into such a scheme as is advocated for the adults by Kemp (1913), who says that the genera fall into two groups, with *Squilla*, *Pseudosquilla*, *Lysiosquilla* and *Coronida* on the one hand, and *Gonodactylus* and *Odontodactylus* on the other. This is quite different from the arrangement given above, where *Pseudosquilla* is allied to *Gonodactylus* and *Odontodactylus*.

As regards the course of development, the *Erichthus* larvae are also divided into groups; here again *Pseudosquilla* is brought into proximity with *Gonodactylus* (Calman). The other group is formed by *Lysiosquilla* and *Coronida*, which show a lengthy metamorphosis, involving the transformation of the biramous thoracic appendages into the typical chelate limb.

---

* Perhaps it is as well to point out here that Hansen, in the "Plankton" report, calls these appendages "Greiffüsse" 1, 2 and 3; in the "Siboga" report he calls them thoracic legs 2, 3 and 4. Calman (1909) calls them thoracic appendages 3, 4 and 5; and it is this last method that I shall adopt here.

It would not appear that the alliance of *Pseudosquilla* with *Gonodactylus* carries any great weight, for, as Calman (1909) has pointed out, *Alima* larvae themselves belong to the same group, that is to say, they hatch at the same stage.* The difference here is really therefore between *Lysiosquilla* and *Coronida* on the one hand, and *all* the other genera on the other. This difference appears to be of little phylogenetic importance, for it is probable that the primitive life-history was like that of a *Lysiosquilla*, and then the provision of more yolk in the egg resulted in the *Squilla* and *Pseudosquilla* type of life-history, where emergence from the egg takes place at a later stage of development, the anterior appendages developing directly and the posterior ones being suppressed; such a condition might have arisen on several independent occasions. The possibility of the genera *Lysiosquilla* and *Coronida* showing a return to the earlier form, by the provision of less yolk in the egg, and thus being revertive rather than primitive, cannot be disregarded.

With regard to the separation of the forms *Alima* and *Erichthus* on morphological grounds, the only constant difference yet recorded is that first noted by Brooks (1886), and quoted both by Giesbrecht (1910) and by Hansen (1926). Brooks pointed out that in *Alima* there are always more than four intermediate denticles between the submedian and lateral denticles of the telson, whilst in the larvae of the other genera (*Erichthus* forms) there is only one such intermediate denticle. It does not seem that this character, which is only regarded as of generic value in the case of the adult *Squilla*, warrants the segregation of the *Alima* and the *Erichthus* forms such as has always taken place in the past.

The key to the genera of the larvae is intended for use with larvae of all stages, and shows the following points:

(1) That the larvae can be classified in the same way as Kemp has suggested for the adults.

(2) That the characters of the larvae bear a very definite relation to those of the adults, the likeness to the adult becoming greater at each successive stage.

(3) That the difference between the *Alima* and the *Erichthus* types is not fundamental as has been supposed, but is really a minor generic modification.

KEY TO THE GENERA OF LARVAL STOMATOPODA.

(1) Larvæ hatch either with biramous thoracic appendages, or with the raptorial claw developed and no appendages on the third, fourth and fifth segments of the thorax. In the raptorial claw the upper margin of the propodus is finely pectinate and the ischio-meral articulation is always terminal.

(*a*) Larvæ hatch with the raptorial claw developed; the so-called "hand" of the fourth thoracic leg is oblong and generally longer than broad, and scarcely bigger than that of the fifth leg.

i. Telson with more than four intermediate denticles between the submedian and lateral denticles . . . . *Squilla*. [*Alima*.]

ii. Telson with less than four intermediate denticles between the submedian and the lateral denticles . *Pseudosquilla*. [*Pseuderichthus*.]

---

* It would appear that no Stomatopoda hatch at a stage earlier than the well-known early stages; Lister's so-called metanauplius of a Stomatopod, which has been described and figured in several text-books, has been shown by Gurney (1924) to be a larval decapod.

(*b*) Larvæ hatch with biramous thoracic appendages (*Erichthoidina* stage), which undergo a transformation into the typical chelate form. The "hand" of the fourth thoracic appendage is rounded, often broader than long, and more than twice as big as that of the fifth leg.

i. Propodus of the raptorial claw broad and the dactylus slightly inflated at the base . . . . . . *Coronida*. [*Coroniderichthus*.]

ii. Propodus of the raptorial claw slender and no trace of inflation at the base of the dactylus . . . . *Lysiosquilla*. [*Lysioerichthus*.]

(2) Larvæ always hatch with the raptorial claw developed and no appendages on the third, fourth and fifth segments of the thorax. In the raptorial claw the upper margin of the propodus is never pectinate, and in later stages the ischiomeral articulation becomes situated at a point in advance of the proximal end of the merus.

(*a*) The spines of the telson are greatly elongated *Odontodactylus*. [*Odonterichthus*.]

(*b*) The spines of the telson are not greatly elongated *Gonodactylus*. [*Gonerichthus*.]

THE REFERENCE OF LARVAE TO ADULT FORMS.

The only really sure way of referring a larva to its appropriate adult is by the use of intermediate post-larvae which combine certain characters of the larva with others of the adult; unfortunately post-larvae are entirely lacking in the present collection.

One reference has been attempted, however, by the methods which are discussed by Hansen (1895). More recently Calman (1917) has pointed out that the number of epipodites present on the thoracic appendages varies in the Atlantic species of *Squilla*, and this has provided a useful check on the reference of larvae to the adults.

The following is a list of some species of larvae and adults which have been linked up:

Larva.	Adult.	Epipodites.		Authority.
		Larva.	Adult.	
No larval name	*S. desmaresti*	4	4	Giesbrecht (1910).
,, ,,	*S. mantis*	5	5	,, ,,
,, ,,	*S. empusa*	5	5	Brooks (1879).
A. hyalina	*S. dubia*	4	3	Hansen (1895).

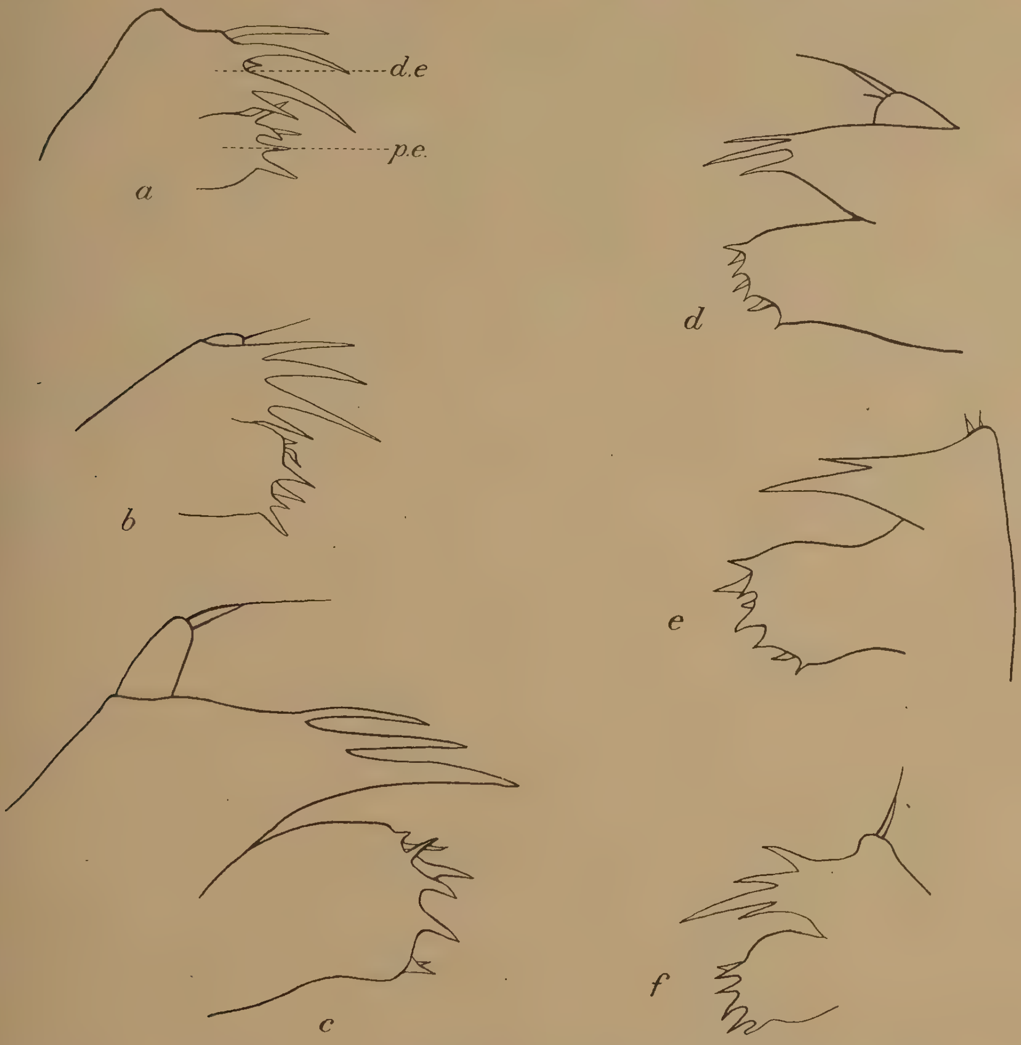
Hansen, who says that *Alima hyalina* is probably the larva of *Squilla dubia*, does so mainly for reasons of geographical distribution, but his suggestion does not appear to be justified by the above evidence. It is not probable that an epipodite would be lost at the post-larval stage, as the general trend in the development of all Stomatopod larvae is towards a gradual assumption of the adult characters.

THE FEEDING MECHANISMS OF THE LARVAE.

The large numbers of individuals of *Lysioerichthus tectus* present in the collection has allowed a study of the mouth-parts and the associated structures to be made; and a comparison of *Lysioerichthus tectus* and *Coroniderichthus rostratus* with representatives of the other genera has demonstrated that the mouth-parts of the larvae show a rather considerable morphological variation, which can be correlated with the methods of feeding and of obtaining food.

Filter-feeding has been stated to occur in the Peracarida, Syncarida and Eucarida and in the larvae of the more primitive Decapods (Cannon and Manton, 1929).

If filter-feeding were to occur in the Stomatopoda it should be looked for in the earliest stages of the larvae of *Lysiosquilla* and *Coronida*, where the raptorial appendages are not formed, but an examination of the mouth-parts shows at once that no filter-feeding mechanism can exist, and that the appendages of the thorax are solely natatory in function; it is when the abdomen and its appendages are developed and presumably can take on the swimming function, that the thoracic appendages undergo transformation into the typical chelate form.



Text-fig. 1.—Maxillules of: *a*, *Lysioerichthus tectus* (M. Edw.), 4-mm. stage; *b*, *Coronid-erichthus rostratus* (Borradaile), 4-mm. stage; *c*, *Lysioerichthus tectus* (M. Edw.), 14-mm. stage; *d*, *Alima emarginata*, Claus, 5-mm. stage; *e*, *Alima emarginata*, Claus, 10-mm. stage; *f*, *Gonodactylus*, sp., 6-mm. stage. *d.e.*, Distal endite; *p.e.*, proximal endite. All to the same scale.

The larvae of *Lysiosquilla* and *Coronida*, hatching as they do without raptorial appendages, are clearly at a disadvantage when compared with the larvae of the other genera. A peculiar modification of the maxillule is to be seen in the larvae of these two genera.

Text-fig. 1, *a* shows the maxillule of a 4-mm. *Lysioerichthus tectus*, and it will be noticed that the distal and proximal endites are approximately equal in size; if there is any difference it is that the distal endite is larger than the proximal one, also the proximal endite is not armed with many spines. The same is true of *Coroniderichthus rostratus;* Text-fig. 1, *b* shows a maxillule from a 4-mm. stage.

By the time that the 14-mm. stage is reached in *Lysioerichthus* (see Text-fig. 1, *c*) the proximal endite is becoming more important and is markedly more spinose. On the other hand, at the earliest stage of *Alima emarginata* (Text-fig. 1, *d*), 5 mm. specimen, the proximal endite is already larger than the distal endite and is armed with a considerable number of spines. This difference in size becomes even more pronounced by the time that the 10-mm. stage is reached (Text-fig. 1, *e*); *Gonodactylus* (Text-fig. 1, *f*) and *Pseudosquilla* (see Giesbrecht, 1910) show the same thing.

I wish to suggest, therefore, that in the larvae of *Lysiosquilla* and *Coronida* the maxillule in the earliest stages takes no part in the mastication or maceration of the food, but serves the purpose of holding the food against the mandibles; the elongation of the distal endite of the maxillule appears to be a particular modification for this purpose, whereas in the other genera the grasping function is taken on by the chelate thoracic appendages at a very early stage.

A comparison of the maxillule of *Lysioerichthus tectus* with that of the zoea of *Carcinus maenas* appears to confirm this view. Williamson (1903) gives some figures of the maxillule of the zoea of *Carcinus;* in this case the distal endite retains its dominance over the proximal endite in the later stages of development, but at the same time, in the early stages the distal endites of the maxillules of *Carcinus* and *Lysioerichthus* show a marked resemblance such as might well be concerned with a similarity of function. The feeding mechanism of the zoea of *Carcinus* is, however, known and has been briefly described by Dr. Lebour (1928), who points out that in her experiments no larvae of the Brachyura were reared on a vegetable diet alone, and that "the larvae of oysters and other molluscs, worms and echinoderms are apparently the natural food, and quite small zoeae have been seen to eat them, smashing up the mollusc shells and echinoderm spines with their powerful mandibles, whilst holding the food partly with the other mouth-parts and partly with the abdomen curled under the body." It would appear safe to assume that *Lysiosquilla* and *Coronida* larvae use their mouth-parts in a similar manner.

SYSTEMATIC NOTES.

Many of the larvae occurred at most of the stations, so that no station list is given as it would be of little value. Any points of interest in the occurrence or distribution of the species are noted under the species concerned. Mr. Russell's forthcoming paper on the Zooplankton will deal with the quantitative aspect of the distribution and such details are omitted here. The station numbers refer to the list already published (Russell and Colman, 1931).

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INVESTIGATIONS

Squilla, J. C. Fabricius.

1. *Squilla*, sp.

[*Alima emarginata*, Claus.]
[*A. emarginata*, Claus, 1872.]
[*A. emarginata*, Lanchester, 1906.]

Occurrence.—With a few exceptions this species was found regularly at the weekly plankton station ; it was also taken at most of the other stations both inside and outside the reef.

Remarks.—Many specimens in all stages of the life-history were taken all the year round, and this points to the species having a prolonged larval life.

Lanchester's figure is hardly typical, especially as regards the telson ; and the spinulation of the carapace, of which he gives details, varies greatly, the arrangement as shown by Claus (fig. 33) not being arrived at until a length of 25–30 mm. is reached.

The largest specimen in the collection measures 35 mm. in length including the rostrum, and it closely resembles Claus's figure ; it has one less spine showing beneath the skin of the dactylus of the raptorial claw and seven spines on the exopodite of the uropod. Claus's specimen measured 44 mm.

The first four thoracic appendages bear epipodites.

2. *Squilla*, sp.

[*Alima pyramidalis* (Lanchester).]
[*Alimerichthus pyramidalis*, Lanchester, 1903.]
[*Alimerichthus unidens*, Lanchester, 1903.]
[*Alimerichthus α*, Tattersall, 1906.]

Occurrence.—This species was found at the weekly station during the greater part of the year, being taken for the first time on 6th September, 1928, and for the last time on 17th July, 1929 ; but it was most common from November to June. It was also found at most stations inside the reef but only once outside it, namely station L, outside Papuan Pass.

Remarks.—I am unable to agree with Lanchester and Tattersall that the forms which they describe are really three different species. The characters used by these authors to differentiate the three species resolve themselves into—

(1) The position of the subordinate spines on the carapace,
(2) The spinulation of the telson,
(3) The stage of development reached compared with the length of the specimen.

An examination of the large number of specimens of this type of *Alima* collected by the Expedition shows that all these three characters are subject to a great amount of variation. In the first place, forms which appear to be exactly alike in other respects may have no medio-lateral spine on the carapace, or they may possess one or two such spines. Again the spinulation of the telson varies ; Tattersall, in describing *Alimerichthus α*, says that between the submedian and the intermediate spines there are seven intermediate denticles ; his figure, however, shows only six such denticles ; and in the Barrier Reef material the number of intermediate denticles is seen in some cases to differ on the two sides of the same telson. Then as to comparative size ; Lanchester observed that the quite small specimen, which he called *Alimerichthus unidens*, showed the same stage of development at 12·5 mm. as was shown by *A. pyramidalis* at 17 mm. He noted, too, that *A. unidens* had one fully-developed spine on the dactylus as well as the terminal one. In the Barrier Reef material the degree of the development of the spines on the dactylus appears to be particularly subject to variation; the development of these spines might well depend on a considerable number of factors, both internal and external. Again, with regard to size, Tattersall points out that *Alimerichthus* α is at a later stage at 9 mm. than *A. unidens* at 12 mm. or *A. pyramidalis* at 16 mm., and remarks that it evidently belongs to a smaller species of adult than do the other two species. On the other hand, when describing a form which he calls *Alima* α he says that some forms at 19 mm. are more developed than some at 27 mm., but apparently he is satisfied that the two forms belong to the same species; if this is so, there would appear to be no justification for making *Alimerichthus* α a new species on account of its size.

In support of the view that the Barrier Reef forms all belong to one species, it may be pointed out that in most cases the larvae seemed to be forming homogeneous swarms in the plankton.

The comparatively early assumption of advanced characters by small larvae is typical of the *Alimerichthus* forms, and indeed of *Alima* larvae in general; the prolongation of larval life which appears to have taken place in this genus comes at the end of the larval stage, when many advanced characters have been assumed, not at the beginning.

The largest forms were found in February and March, 1929, when specimens measuring 18 mm. were taken.

3. *Squilla*, sp. (? *lata*, Brooks). (Text-figs. 2 and 3.)

[*Alima*, sp.]

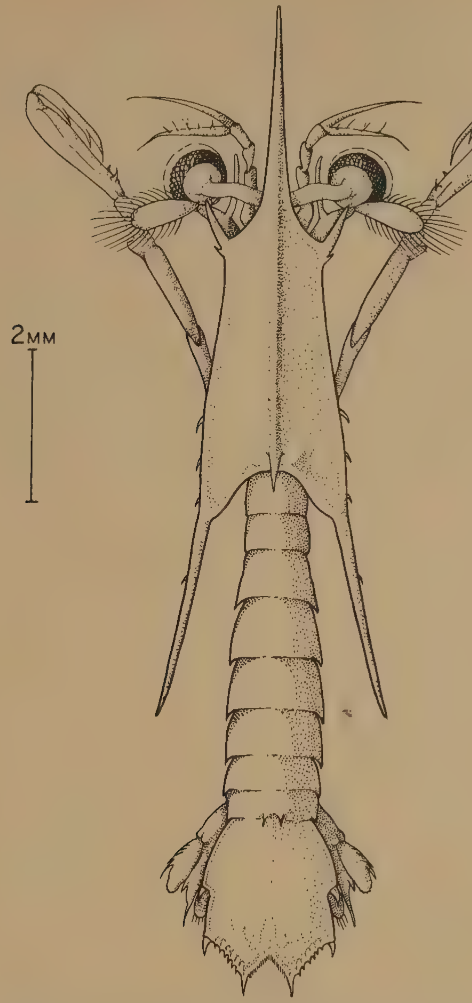
Occurrence.—This species was found at many stations, and nearly all the year round at the weekly station, but it was rare in July, August and September. It was also taken at Stations XLIII, XLIV, XLIX, inside the Reef, and at Station XLV outside it; this species did not occur in Trinity Opening.

Remarks.—This species of *Squilla* larva does not appear to have been described before; as, for reasons given below, it is thought that this form may be the larva of *Squilla lata*, Brooks, a brief description is given.

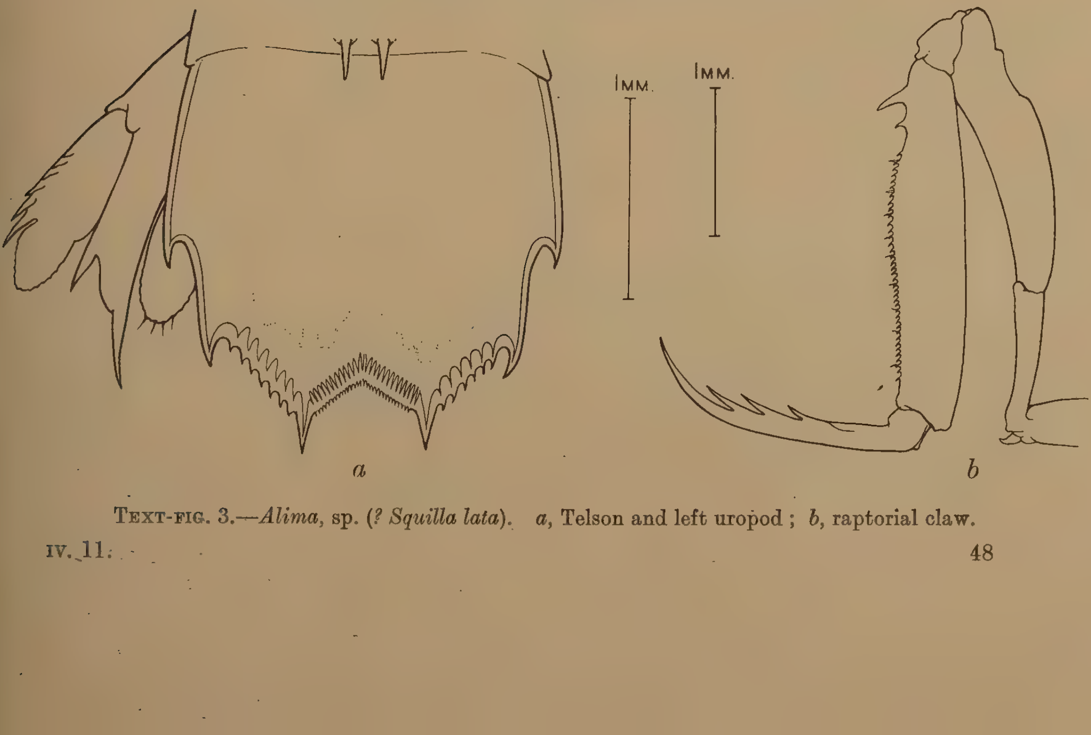
Few of the larvae exceed 16 mm. in length, and at this size appear to be ready for the final moult; the largest specimens are 18 mm. in length.

In general appearance this species resembles *Alima longicaudata*, Jurich (1904).

The carapace, which is three times as long as it is broad, leaves the last three segments of the thorax exposed dorsally. The rostrum is not as long as the antennal flagella, or as long as the posterior lateral spines; ventrally it bears four spines. The anterior lateral spines are short and point forward, each has one ventrally directed spine beneath. The lateral margins of the carapace are armed posteriorly, just in front of the posterior lateral spines, with three ventrally directed spines; the posterior lateral spine itself bears a ventrally directed spine. The "zoea" spine is small, and the carapace only slightly raised near its base. The posterior margin of the carapace is slightly inflected downwards. A dorsal carina, which is not very well marked, traverses the length of the carapace from the rostrum to the "zoea" spine. The only other *Alima* larvae with such carinae are *A. bidens*, Claus, and *Alima* α, of Tattersall.



TEXT-FIG. 2.—*Alima*, sp (? *Squilla lata*). Dorsal view.



TEXT-FIG. 3.—*Alima*, sp. (? *Squilla lata*). *a*, Telson and left uropod ; *b*, raptorial claw.

In a specimen 14 mm. long, four of the thoracic appendages have epipodites, and all the appendages are well developed.

The raptorial claw (Text-fig. 3, *b*) has a rather inflated propodus and a slender dactylus; in well-grown specimens four spines, including the terminal one, are fully-formed, and two more are apparent beneath the skin. A slightly earlier stage is figured.

There are six spines on the exopodite of the uropod (Text-fig. 3, *a*).

The submedian carinae of the abdominal segments end in spines only in the sixth segment.

For the following reasons it is suggested that this larva belongs to *Squilla lata*, Brooks :

(1) Six teeth on the dactylus of the raptorial claw.
(2) Only the submedian carinae of the sixth abdominal segment end in spines.
(3) The similarities seen in the telson and in the uropods.

The only discrepancy between the two is that in the larva there are no serrations on the inner side of the spines of the uropods, such as are present in the adult.

Pseudosquilla, Dana.

4. *Pseudosquilla*, sp.

[*Pseuderichthus affinis*, Borradaile.]
[*Erichthus*, sp., Claus, 1872.]
[*Pseuderichthus affinis*, Borradaile, 1907.]

Occurrence.—This species was present in the plankton in small numbers only. At the weekly station it was found at intervals throughout the year, but was absent from February to June. Other localities were Stations VIII, XI, XLIV, XLIX, all inside the reef. On 16th November, 1928, specimens were taken in the tow-nets in the Low Isles Anchorage.

Remarks.—Although Borradaile assigns this species to the genus *Pseuderichthus* with a query, his determination appears to be correct.

The largest specimens are somewhat more advanced than that figured by Claus (fig. 33); his specimen was 8 mm. long; the Barrier Reef examples are 10 mm. in length.

The uropods are, in this stage, as long as the telson and the spines of the uropods somewhat longer than this. The five thoracic appendages are well developed and the last three are just becoming biramous. There is no trace of any spines on the dactylus of the raptorial claw and its merus is somewhat inflated. The pectination of the propodus is very conspicuous.

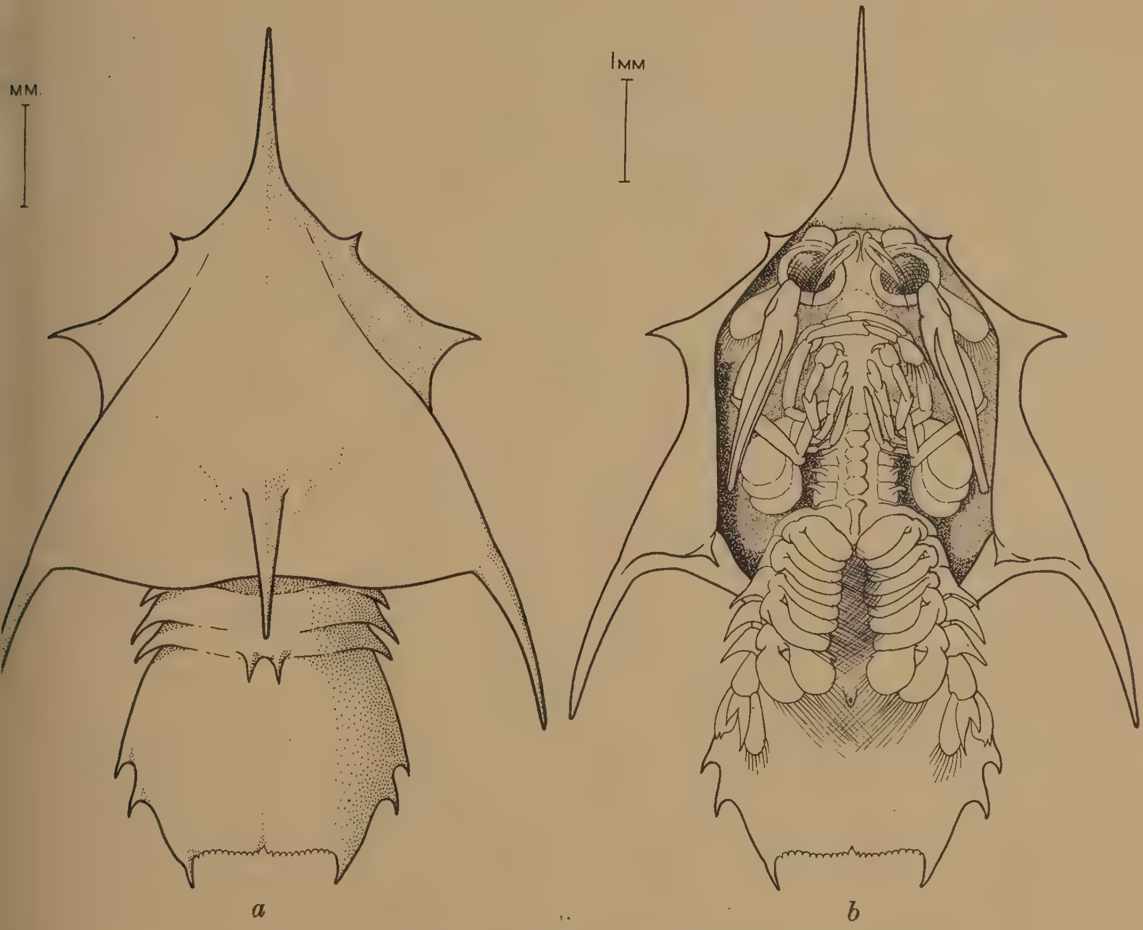
Lysiosquilla, Dana.

5. *Lysiosquilla*, sp. (Text-fig. 4.)

[*Lysioerichthus tectus* (M. Edw.).]
[*Erichthus tectus*, Milne Edwards, 1837.]
[*Erichthus tectus*, Dana, 1852.]

Occurrence.—This form occurred for a short time during the year, and was taken at the weekly station from 21st November, 1928, until 18th February, 1929 (Stations XXVII, XXX, XXXIII–XLII inclusive). It was not found at any other locality.

Remarks.—This species does not appear to have been found since it was first described by Milne Edwards, who gives a brief description of this form and says that it is very like *Erichthus triangularis*, M. Edw., from which it is differentiated by the possession of a medio-lateral spine on the carapace. Unfortunately he does not figure this species, but Claus (1872) gives good figures of *E. triangularis*, M. Edw. (not *E. triangularis*, Brooks), and there is little room for doubt in the determination of this species. As this species has not been figured before, figures of both dorsal and ventral views are given.



TEXT-FIG. 4.—*Lysioerichthus tectus* (M. Edw.). *a*, Dorsal view; *b*, ventral view.

The great size of the carapace is most striking. In the largest specimen, of which the total length is 15 mm., there are no traces of teeth on the dactylus. All the *Lysiosquilla* larvae which were collected belong to this species, and it is peculiar that the larvae of *Lysiosquilla maculata* were not found.

A very large number of forms in all stages were taken, and they have formed the basis of the notes on the mouth-parts made above.

Coronida, Brooks.

6. *Coronida*, sp.

[*Coroniderichthus rostratus* (Borradaile).]
[*Erichthus*, sp., Claus, 1872.]
[*Erichthus* (? *Odonterichthus*) *rostratus*, Borradaile, 1907.]

Occurrence.—This species was first found at Station VIII (Trinity Opening). Afterwards it occurred at the weekly station (Stations XIV, XXII, XXIII, XXXIV, XLII, LII), and also at Stations XLIII, XLVI, and XLIX, all inside the reef. On 18th October, 1928, this species was taken in the Low Isles Anchorage plankton.

Remarks.—The specimens collected by the Expedition are undoubtedly *Coroniderichthi*. They are identical with both the figures given by Claus and with the actual specimens collected by the "Sea-Lark" Expedition.

The pectination of the merus of the raptorial claw and the shape of the third, fourth and fifth thoracic appendages preclude the possibility of these forms belonging to an *Odontodactylus*, and the inflated propodus and rather swollen dactylus of the raptorial claw show that it does not belong to a *Lysiosquilla*.

The specimens are nearly all small, the largest being between 10 mm. and 12 mm.

Gonodactylus, Latreille.

7. *Gonodactylus*, sp.

[*Gonerichthus*, sp.]

Occurrence.—This species did not occur on many occasions. It was taken occasionally at the weekly station from August, 1928, until January, 1929 (Stations V, VII, XXI, XXII, XXXVI, XXXIX). Other localities were: Trinity Opening (Stations VIII and XI), inside Papuan Pass (Station XLIX). It was not found outside the reef.

Remarks.—The specimens of *Gonerichthus* larvae all belong to one species, and as *Gonodactylus chiragra* is so common on the reef it is highly probable that they are the larvae of this form. Of the forms previously described this species is most like that shown by Brooks (1886), pl. xii, fig. 5. The greatest point of similarity is that there is no "zoea" spine. Although Brooks's form came from the Atlantic, he states that a similar form was found in the Celebes sea, and of this he figures the telson. The suggestion that these two forms belong to the same species seems hardly feasible, as no one species of *Gonodactylus* occurs in both the Atlantic and the Pacific. The telson of the Barrier Reef specimen is very similar to that of the one from the Celebes sea, and these two specimens probably belong to the same species.

If these forms are the larvae of *G. chiragra*, it may be that the Atlantic form described by Brooks is the larva of *G. Oerstedii*, Hansen.

The largest specimen is 15 mm. in length. There is no "zoea" spine. The rostrum has six spines on the ventral surface. There are a few spines (not pectination) on the proximal part of the propodus of the raptorial claw; the dactylus is very slender. The outer spine of the uropod is much elongated, the inner almost suppressed. The uropod is not as long as the telson; the telson is slightly longer than broad; the spines of the telson are as long as those shown in *Odonterichthus tenuicornis*, Jurich (1904, pl. xxviii, fig. 4), or even a little longer; this would appear to be contradictory to what is stated in the key, but Hansen (1926) expresses himself doubtful as to the correctness of Jurich's determination of the genus, so that this point has been disregarded.

CUMACEA.

INTRODUCTION.

The collection of Cumacea is small, but nevertheless provides material of interest. It has been possible to name seven species, and two others appear to be represented; three of the determinable species are regarded as new. Owing to the specimens having been preserved in formalin they have suffered to a large extent from decalcification; several are so damaged that identification is impossible, and it is probable that when further material becomes available, the descriptions of the new species may require revision, at least as far as the carapace is concerned.

The small size of the collection is largely due to the infrequency with which plankton collections were made at night. Only on one occasion were Cumacea found during the day, and that was at Station XXIX, where they were taken in the bottom stramin net.

The Cumacea previously known from Australian waters were reviewed by Hale in 1928, and it is significant that not one of the species recorded by him was found by the Expedition. This is no doubt due to the fact that the Eastern coast of the Continent seems to have been left untouched by previous collectors. It appears that the Barrier Reef Cumacean fauna bears some affinity to that of New Zealand on the one hand, and to the more northern fauna on the other; for *Cyclaspis levis* and *Cyclaspis similis*, hitherto known from New Zealand, were both found by the Expedition. *Nannastacus suhmii*, which was also taken, was previously known from the Philippine Islands; and it is noted later that certain species of the genus *Cyclaspis*, which it has not been possible to name, bear affinities to species of that genus previously recorded from North-Western Australia.

There is a very apparent difference between the Cumacean fauna of the Lagoon and that of the deeper waters outside it. At Stations XXI and XXIX *Sympodomma australiensis* and *Campylaspis pileus* both occurred, no other species being taken. In the Lagoon, on the other hand, neither of these species was taken on any occasion, although several species were taken more than once.

LIST OF STATIONS AT WHICH CUMACEA WERE OBTAINED.

Date.	Station.	Time.	Net.	Depth.
1.x.28	Low Isles Anchorage	Night	Medium	Surface.
22.x.28	XXI	8.40–9.10 p.m.	Stramin	22 m.*
16.xi.28	Low Isles Anchorage	7.30 p.m.	Coarse	Surface.
24.xi.28	XXIX	2.17 p.m.	B.S.N.	200 m.
29.xi.28	Low Isles Anchorage	Moonlight	Coarse	Surface.
28.vi.29	,, ,,	Night	Medium	,,

* This is the fishing depth. For details of all Plankton Stations outside the Lagoon Russell and Colman (1931) should be consulted.

SYSTEMATIC NOTES.

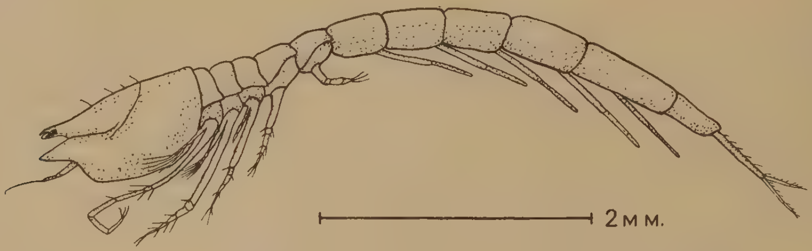
Sympodommatidae.

Sympodomma, Stebbing.

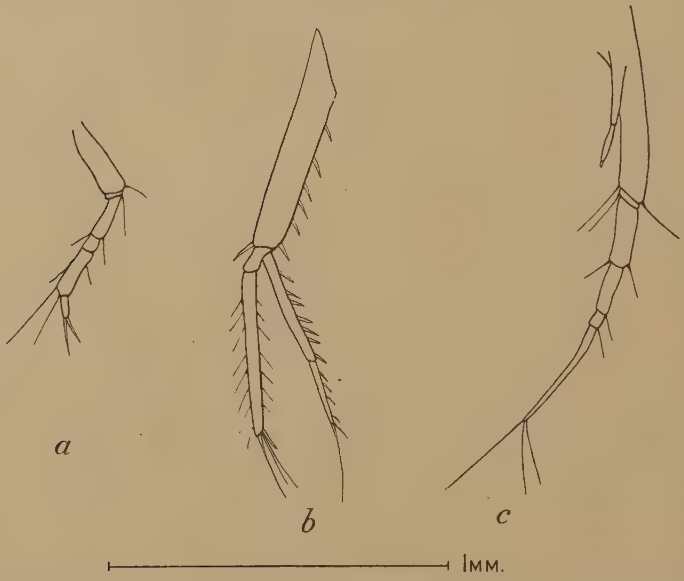
8. *Sympodomma australiensis*, n. sp. (Text-figs. 5 and 6.)

Occurrence.—Stations XXI and XXIX.

Description of a Female 7 mm. in Length.—The body is slender and the uropods are elongated.



Text-fig. 5.—*Sympodomma australiensis*, n. sp. Male. Lateral view.



Text-fig. 6.—*Sympodomma australiensis*, n. sp. *a*, Fifth leg of male; *b*, uropod of male; *c*, second leg of male.

The carapace (Text-fig. 5) is one-fifth of the total length. It has a marked dorsal ridge, which terminates anteriorly in a sharp tooth over the typical elongated ocular lobe, and the ridge is armed by a few hairs and three or four small denticles, not projections of the carapace, as in *Sympodomma africana*, Stebbing. An antennal notch is present. From the pseudorostral lobes slight keels extend obliquely upwards to the middle crest, which they meet in its middle point. A pigmented eye is present at the extremity of the ocular lobe.

The thorax is slightly longer than the carapace, the cephalothorax forming one-third of the total length. The first leg-bearing segment is very narrow dorsally, the fourth segment is the largest. The three posterior segments of the thorax are as slender as those of the abdomen.

The abdomen is long and slender, and forms two-thirds of the total length. The fifth segment is the longest.

In the uropods (Text-fig. 6, *b*) the peduncle is as long as the telsonic segment. The exopod is slightly shorter than the endopod; the endopod is equal in length to the peduncle. The first joint of the exopod is one-fifth the length of the second joint. The rami and the peduncle are armed with sharp spines, those of the exopod are not, however, as strong as those borne by the endopod and the peduncle.

The first legs are one and a half times the length of the carapace. The basis is four-fifths the length of all the remaining joints together. The ischium is small; the merus and carpus are subequal; the carpus is two-thirds the length of the propodus; the dactylus is four-fifths the length of the propodus.

In the second legs (Text-fig. 6, *c*) the basis is, comparatively, slightly longer than in the first legs; the ischium is reduced to a chitinous ring, the propodus is quite small, the merus and carpus are subequal, and the dactylus is nearly as long as the merus and carpus together. In the third to fifth legs (Text-fig. 6, *a*) the ischium is small but quite distinct.

REMARKS.—The males appear to be mature when 8 mm. in length. The pleopods are very long.

This species appears to resemble *Sympodomma weberi* (Calman), but it is much smaller. The two species agree in having no prominent teeth on the dorsal crest of the carapace, but on the other hand, the telsonic segment in *S. australiensis* is triangularly produced between the bases of the uropods, which is not so in *S. weberi*. Also in *S. australiensis* there is only one corneal area with a light pigmentation, whereas *S. weberi* has two distinct corneal areas. The antennal notch is more pronounced than in *S. weberi*.

BODOTRIIDAE.

Cyclaspis, G. O. Sars.

The members of this genus have suffered greatly from the method of preservation, and the sculpturing of the carapace can only be made out with great difficulty, and in some cases not at all. In addition to the species described below there are members of at least two other species in the collection; unfortunately, owing to the state of preservation, it is useless to attempt to describe them. One of them is interesting, as it shows on the first dorsally visible thoracic segment a crest of hairs, similar to those which have been described by Zimmer (1921 *b*) in *Cyclaspis mjöbergi*, Zimmer, *C. supersculpta*, Zimmer, and *C. candida*, Zimmer, all of which come from North-Western Australian waters.

9. *Cyclaspis levis*, G. M. Thomson.

C. levis, G. M. Thomson, 1892; Stebbing, 1913; Calman, 1917.

OCCURRENCE.—29th November, 1928, and 28th June, 1929, Low Isles Anchorage.

REMARKS.—Although the two specimens are smaller than those previously described I do not hesitate to assign them to this species.

They are not well preserved, but it is possible to make out the dorsal keel on the otherwise smooth carapace, the proportions of both the parts of the body and of the joints of the limbs are the same as in the specimens previously described.

The long apical seta on the basis of the first leg is very conspicuous; the proportions of the uropods are typical, and their armature is nearly typical, but the hairs on the endopod are comparatively few.

10. *Cyclaspis similis*, Calman.

C. similis, Calman, 1907; Stebbing, 1913; Calman, 1917.

Occurrence.—16th November, 1928, Low Isles Anchorage.

Remarks.—One male and one female were taken. They are both smaller than the specimens of this species previously described. They are not well preserved, but show the chief characters of the species.

DIASTYLIDAE.

Dimorphostylis, Zimmer.

11. *Dimorphostylis australis*, n. sp. (Text-figs. 7 and 8.)

Occurrence.—1st October, 1928, 16th November, 1928, and 28th June, 1929, Low Isles Anchorage.

Description of Female 5 mm. in Length.—The carapace (Text-fig. 7, *a* and *b*) forms one-fourth of the total length; it is broader than deep, and has the dorsal surface well arched. The pseudorostrum is small and not very acute. There is a well-marked eye, behind which there is a small flattened area of the carapace, which bears four tubercles; posterior to this the carapace is well rounded and the crest slopes down to the hinder margin. The sides of the carapace are ornamented with two parallel lateral keels; these are not continuous over the crest, but terminate a little distance on either side. The antennal notch is nearly obliterated.

In the thorax there are five free segments, which together are slightly shorter than the carapace; of these the fourth is the largest.

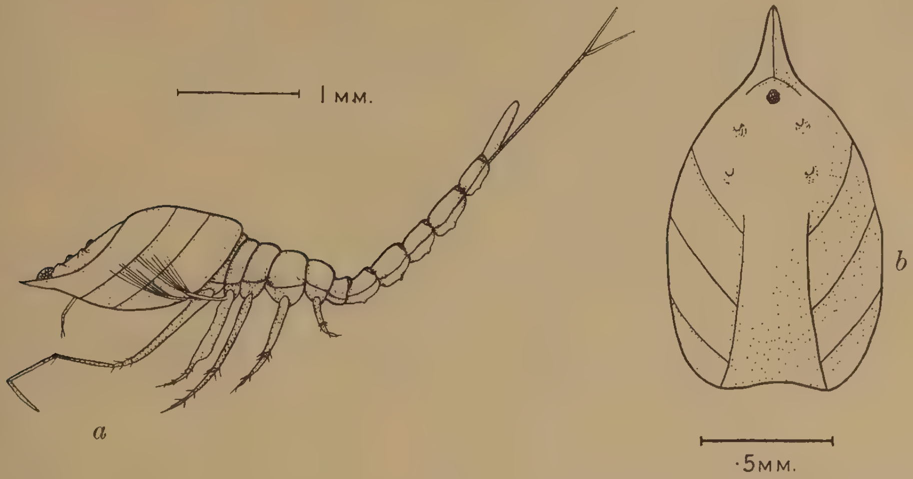
The abdomen is more slender than the cephalothoracic region. The segments of the abdomen are armed ventrally with spines. In the males very strong spines are borne on the third and fourth abdominal segments in a position corresponding to that in which the pleopods are found in the preceding segments.

The telson (Text-fig. 8, *b*) is longer than any segment of the abdomen, but it is only two-thirds the length of the peduncle of the uropods. The anus opens at the distal end of the telson and its opening is guarded by two distinct valves. In the male two distinct post-anal spines are conspicuous. I think that it is highly probable that these spines also occur in the females, but this is not obvious in any of the specimens in the collection.

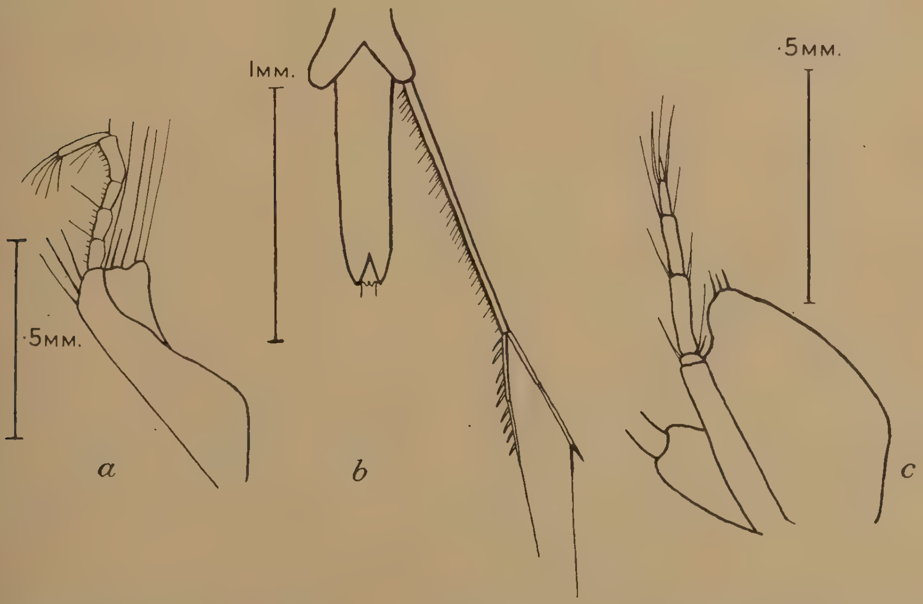
The uropods (Text-fig. 8, *b*) are greatly elongated, being much longer than the telson; the basal joint is armed with spines. The endopod is nearly as long as the exopod. The two basal joints of the endopod are armed with spines; the exopod is unarmed.

The antennule is as long as the carapace; the first segment of the peduncle is larger than either of the two segments. The outer flagellum is longer than the peduncle; the inner much shorter than the outer.

The first legs are less than twice as long as the carapace; the dactylus is less than twice the length of the propodus; the carpus and propodus are subequal.



TEXT-FIG. 7.—*Dimorphostylis australis*, n. sp. *a*, Lateral view of female; *b*, carapace, dorsal view.



TEXT-FIG. 8.—*Dimorphostylis australis*, n. sp. *a*, Third maxilliped of male; *b*, telson and uropod of male, ventral view; *c*, third leg of male.

In the second leg the exopod and endopod are subequal. The second leg is much shorter than the first.

The third (Text-fig. 8, *c*) and fourth legs are slightly longer than the second leg.

The thoracic legs show in a very marked way the lamellar expansion of the basis characteristic of the genus. The basis is produced on the inner side as a large leaf-like expansion which is turned forwards; terminally it is produced so that it extends further than the distal end of the ischium.

REMARKS.—This species is placed in the genus *Dimorphostylis*, founded by Zimmer (1921 *a*) for the reception of a species called *D. asiatica*, Zimmer; this is done for the following reasons:

(1) The similarity in the sculpturing of the carapace in the two species.
(2) The shape of the basis in the thoracic legs.
(3) The similarity exhibited by the uropods.
(4) The similarity that exists between the structure of the telson of the female of *D. asiatica* and the telson of both sexes of *D. australis*.

The main difference between the two species is to be found in the telson of the males. Whereas in *Dimorphostylis australis* there is apparently little difference between the telson in the two sexes, in *D. asiatica* there is a great difference, the male possessing quite a large post-anal portion which is absent in the female. It should be pointed out that, although the telson of *D. australis* is very like that of the female of *D. asiatica*, it is much longer and bears approximately the same relation in proportion to the uropods as does that of the male in *D. asiatica*.

It appears, therefore, that the marked sexual dimorphism, which is one of the most marked characters of *Dimorphostylis asiatica*, and indeed the character which gave the name to the genus, is not a noticeable character of *D. australis*—a form that has to be placed in this genus for other reasons.

NANNASTACIDAE.

Nannastacus, Bate.

12. *Nannastacus suhmii*, G. O. Sars.

N. suhmii, G. O. Sars, 1886.
N. suhmii, Stebbing, 1913.
N. suhmi, Zimmer, 1921 *a*.

OCCURRENCE.—1st October, 1928, and 29th November, 1928, Low Isles Anchorage.

REMARKS.—Only males were taken; their average length is 2·3 mm. Although the specimens are poorly preserved I do not doubt that they belong to this species. The only member of this genus previously described from Australian waters is *N. nasutus*, Zimmer (1914), and this record is from South Australia; *N. nasutus* and *N. suhmii* are very dissimilar.

In his description of the male of *Nannastacus suhmii*, Sars states that the flagellum of the second antenna does not extend further backward than the third segment of the abdomen. The Barrier Reef specimens have this flagellum extending as far as the last abdominal segment. I have re-examined the "Challenger" type-specimens which have been dismounted by Dr. Calman (see Calman, 1905), and it is quite clear that the antennal flagella do extend the whole length of the abdomen; the same is the case in the specimens of the "Siboga" Expedition referred to this species by Dr. Calman (*loc. cit.*).

Cumella, G. O. Sars.

13. *Cumella*, sp.

Occurrence.—28th June, 1929, Low Isles Anchorage.

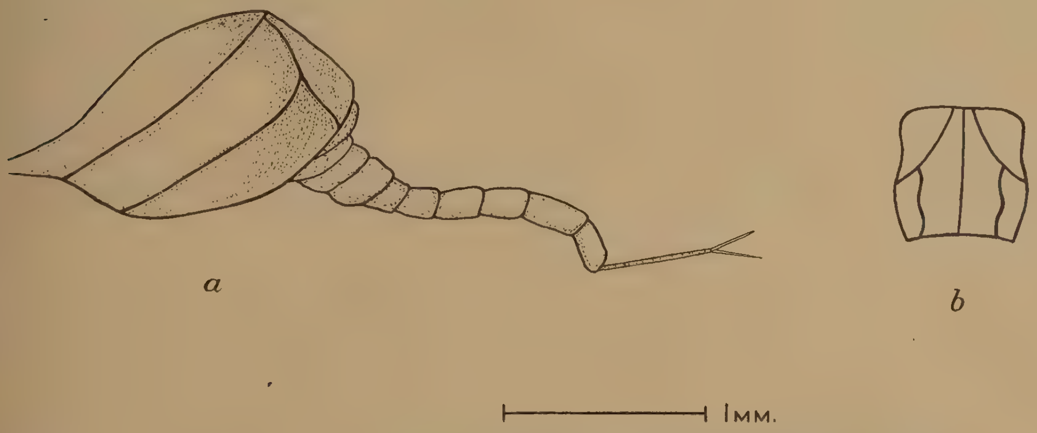
Remarks.—In general appearance this species resembles *Cumella cyclaspoides*, Zimmer (1914), but the uropods are distinctly longer.

I have not attempted to describe this species as no female specimens are present in the collection, and in the light of Dr. Calman's remarks (1911) little purpose would be served by a description based on the male forms only.

Campylaspididae.

Campylaspis, G. O. Sars.

14. *Campylaspis pileus*, n.sp. (Text-figs. 9 and 10.)

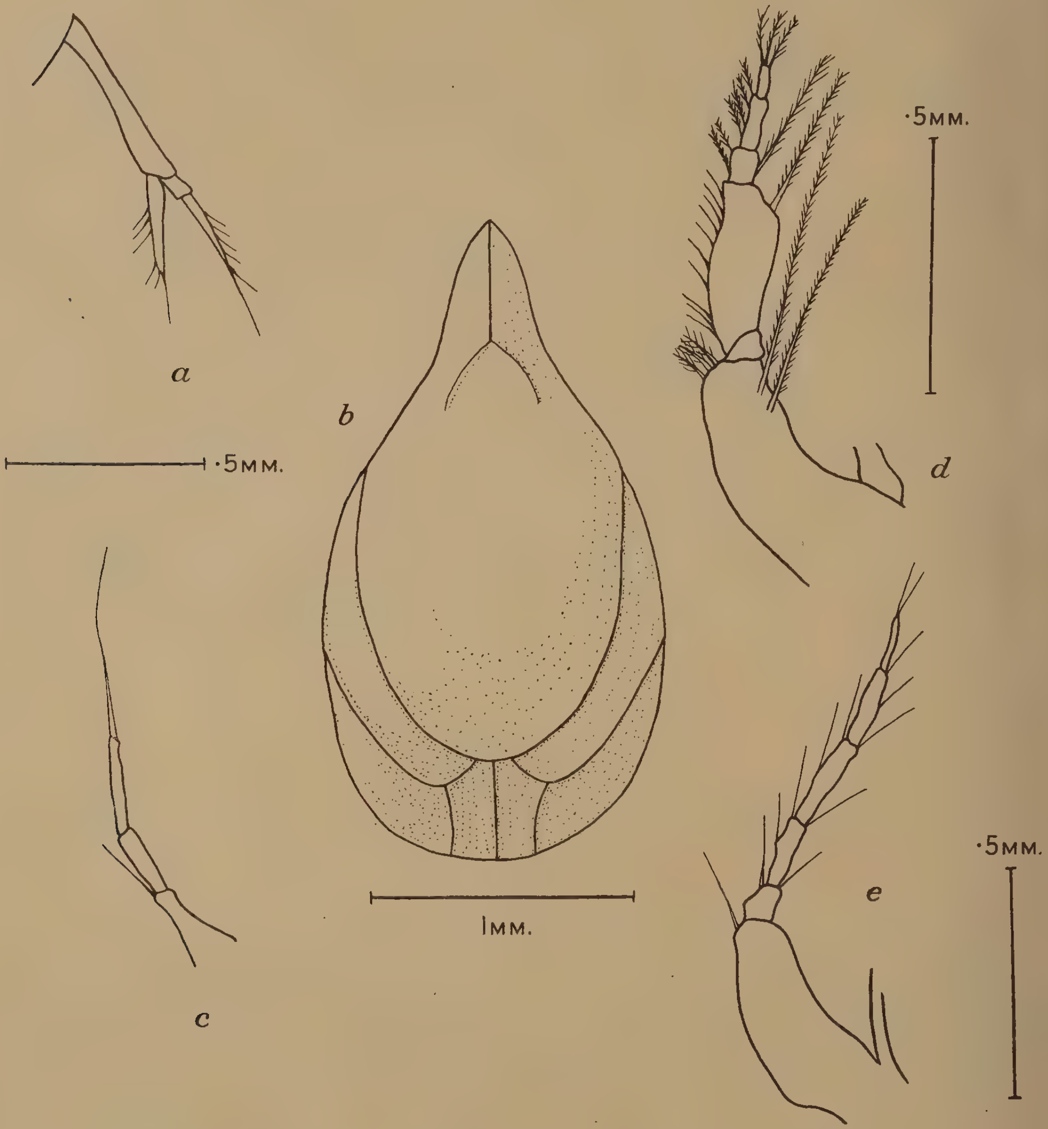


Text-fig. 9.—*Campylaspis pileus*, n. sp. *a*, Lateral view of female, the appendages omitted; *b*, the carapace from the rear.

Occurrence.—Stations XXI and XXIX.

Description of a Female 3·5 mm. in Length.—The carapace (Text-figs. 9, *b*, and 10, *c*) is a little less than half the total length; it is very broad, and dorsally it has a large flattened area marked off by a strong keel, which extends round the carapace from below the pseudorostral lobe on one side to a similar position on the other. Externally to this first keel the carapace inclines sharply downwards, so that the sides of the carapace are nearly at right-angles to the dorsal surface. Half-way between the first keel and the margin of the carapace there is a second keel; laterally it is parallel to the first keel, but posteriorly it turns upwards and meets the first keel quite close to the middle line. On each side of the carapace a third keel extends from the middle of the curve of the second keel to the posterior edge of the carapace. In the middle of the approximately triangular area of the carapace produced on the posterior surface by the intersections of these keels, a fourth keel extends from the most posterior point of the first keel to the hinder margin of the carapace. The fourth keel is not as well defined as are the others.

The pseudorostral lobes are very large, and project far in advance of the ocular lobe. There is no distinct eye and no pigment is present. The integument of the carapace is roughly pitted, but except for the keels there is no marked sculpturing.



TEXT-FIG. 10.—*Campylaspis pileus*, n. sp. *a*, Uropod of female; *b*, carapace, dorsal view; *c*, first antenna of female; *d*, third maxilliped of female; *e*, first leg of female.

The thorax is quite small and slender; all the leg-bearing segments are free, but dorsally they are obscured by the large posterior extension of the carapace.

The abdomen is very slender, the fifth segment being the longest and the pentagonal sixth segment the shortest.

In the Uropods (Text-fig. 10, *a*) the peduncle is twice as long as the sixth segment of the abdomen; the subequal rami are three-fourths the length of the peduncle. The uropods are armed with a few stout spines; there are five on the endopod, four on the exopod and seven smaller spines on the peduncle, but these numbers appear to be subject to variation.

The antennule (Text-fig. 10, *c*) has the accessory flagellum very small.

In the first leg (Text-fig. 10, *e*) the basis is three-fourths the length of the remaining joints; the ischium is small, being half the length of the merus; the carpus is one-fourth longer than the merus. The merus and propodus are equal in length, and the dactylus is equal to two-thirds the length of the propodus. There are many hairs on each segment of the limb.

Remarks.—This species bears certain resemblances to *Campylaspis vitrea*, Calman (1906), but the carapace is not so highly vaulted in *C. pileus* as it is in *C. vitrea*, though there is a general similarity in the arrangement of the keels. There is also some resemblance between *C. pileus* and *C. ovalis*, Stebbing (1912), but they differ in that the greatest breadth of the carapace in *C. ovalis* is in the anterior portion whilst in *C. pileus* it is two-thirds of the way back, being well inside the posterior half of the carapace when viewed dorsally.

CLADOCERA.

The Cladocera are represented in the collections by one species only, and specimens only occurred for a short time during the year.

15. *Evadne tergestina*, Claus.

E. tergestina, Claus, 1877.
E. aspinosa, Krämer, 1895.
E. gibsoni, Brady, 1914.

Occurrence.—This species occurred at the weekly station during December, 1928, and January and February of 1929 (Stations XXXII—XLII inclusive). It was not taken at any other locality.

Remarks.—Several of the specimens tend to confirm Dr. Calman's opinion that *E. gibsoni*, Brady, is synonymous with this species, as they show a deep cervical groove such as Brady described. In all cases this appeared to be due to uneven contraction of the body away from the carapace. The best figures of this species are those given by Krämer under the synonym of *E. aspinosa*.

Previous records for this species are: N. Atlantic and Mediterranean (Hansen, 1899), S. Atlantic (Calman, 1917; Hansen, *loc. cit.*), Californian Coast (Juday, 1907), Indian Ocean (Hansen, *loc. cit.*), Australian waters (Hansen, *loc. cit.*; Krämer, 1895), New Zealand (Krämer, *loc. cit.*), and S. Africa (Brady, 1914).

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INDEX

(The principal references are in heavy type.)

PAGE
affinis, Pseuderichthus **384**
africana, Sympodomma 388
Alima 376, **377**, 382
Alimerichthus 376
asiatica, Dimorphostylis 392
aspinosa, Evadne 395
australiensis, Sympodomma 387, **388**, 389
australis, Dimorphostylis **390**, 392

bidens, Alima 382

Campylaspis **393**
candida, Cyclaspis 389
Carcinus 380
chiagra, Gonodactylus 386
Coronida 376, 377, **378**, 379, 380, **386**
Coroniderichthus **378**
Cumella **393**
Cyclaspis 387, **389**
cyclaspoides, Cumella 393

desmaresti, Squilla 378
Dimorphostylis **390**, 392
dubia, Squilla 378

emarginata, Alima 380, **381**
empusa, Squilla 378
Erichthoidina **378**
Erichthus 376, 377, 384
Evadne 395

gibsoni, Evadne 395
Gonerichthus **378**, **386**
Gonodactylus 376, 377, **378**, 380, **386**

hyalina, Alima 378

lata, Squilla **382**, 384
levis, Cyclaspis 387, 389
longicaudata, Alima 382
Lysioerichthus **378**, 380
Lysiosquilla 376, 377, **378**, 379, 380, **384**, 385, 386

PAGE
maculata, Lysiosquilla 385
maenas, Carcinus 380
mantis, Squilla 378
mjöbergi, Cyclaspis 389

Nannastacus **392**
nasutus, Nannastacus 392

Odonterichthus **378**
Odontodactylus 376, **378**, 386
Oerstedii, Gonodactylus 386
ovalis, Campylaspis 395

pileus, Campylaspis 387, **393**, 395
Pseuderichthus **377**
Pseudosquilla 376, **377**, 380, **384**
pyramidalis, Alima **381**
pyramidalis, Alimerichthus 381, 382

rostratus, Coroniderichthus 378, 379, **386**
rostratus, Erichthus 386
rostratus, Odonterichthus 386

similis, Cyclaspis 387, **390**
Squilla 376, **377**, **381**
Squillerichthus 376
suhmi, Nannastacus 392
suhmii, Nannastacus **392**
supersculpta, Cyclaspis 389
Sympodomma **388**

tectus, Erichthus 384
tectus, Lysioerichthus 378, 380, **384**
tenuicornis, Odonterichthus 386
tergestina, Evadne **395**
triangularis, Erichthus 385

unidens, Alimerichthus 381, 382

vitrea, Campylaspis 395

weberi, Gympodomma 389

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THE POLYZOA

WITH A NOTE ON AN ASSOCIATED HYDROID

BY

ANNA B. HASTINGS, M.A., PH.D.
Assistant Keeper in the Department of Zoology

WITH TWENTY TEXT-FIGURES AND ONE PLATE

INTRODUCTION.

As might be expected, this collection shows a close relationship between the Polyzoan fauna of the Great Barrier Reef and that of the Malayan region. Among the Entoprocta and the Ectoprocta, with the exception of the Ascophora, only two species (*Loxocalyx*, sp., and *Nolella alta*) have not been recorded from Malaya, and the latter is now known from China. Probably, when an account of the Ascophora of the "Siboga" Expedition is available, as close a relationship will be found there too. As will be seen from the list of species (p. 400), the collection adds considerably to the number of species known to occur on the reef.

Mr. A. A. Livingstone, of the Australian Museum, joined the expedition on Low Isles for the months of October and November, 1928. He collected ten species of Polyzoa, including one new species of *Petralia*. On his return he prepared a report on them and sent the specimens to the British Museum, keeping a duplicate series. Subsequently hearing that the collection made by the other members of the expedition was to be described by me, he suggested that it was undesirable to publish two reports, and, sending me his MS., gave me a free hand to use it in preparing my paper and to describe his new species. For this I offer him my sincere thanks.

I am also indebted to the Manchester Museum for lending me specimens from the Waters Collection, to the Cambridge Museum for a loan of specimens, and to Sir Sidney Harmer, K.B.E., F.R.S., for much very valuable help.

COLLECTING STATIONS.

Polyzoa were very scarce on the shore. Some colonies of *Retepora graeffei* developed on a box sunk in the shallow water of the Anchorage at Low Isles, and Mr. Livingstone's collection includes seven species, which he collected on the shore at Low Isles and Batt Reef.

The rest of the collection was obtained by dredge or trawl. The particulars of the six unnumbered stations from which Polyzoa were obtained and the abbreviated titles by which they are distinguished in this report are as follows:

N.E. Low Is.: September, 1928, off N.E. Low Isles, 8 fath., mud, dredge.
N.W. Low Is.: 5.ix.28, off N.W. Low Isles, 9 fath., mud, dredge.
Low Is., 12 fath.: 16.x.28, off Low Isles, 12 fath., dredge.
Off N. Anchorage: 17.x.28, off N. Anchorage, Low Isles, 9 fath., sand, coral fragments, Agassiz trawl.
W. Low Is., 6 fath.: W. of Low Isles, about 6 fath., mixed bottom.
W. Low Is., 8 fath.: 15.xi.28, W. of Low Isles, 8 fath., mud.

Polyzoa were obtained from the following numbered stations:

II. 24.xi.28. Linden Bank, 28 fath., shell and sand, dredge 10 min. and 5 min.
VIII. 21.ii.29. 1½ miles N.W. Low Isles, 11 fath., mud, Agassiz trawl, 30 min.
IX. 22.ii.29. Penguin Channel, 12–14 fath., clean pit with mud at sides, 6 dredges about 20 min. each.
XII. 24.ii.29. Penguin Channel, 10–15½ fath., rock and shell gravel, mud on edges of pit, 5 dredges about 30 min. each.
XIII. 7.iii.29. ½ mile W. of Two Isles, 16½ fath., hard, 2 dredges, 20 min. each.
XIV. 7.iii.29. ½ mile S.E. of Lizard Is., 19 fath., shell gravel, rich *Halimeda*, 3 dredges, 20–30 min. each.
XXI. 11.iii.29. ½ mile N.W. Howick Is., 10 fath., mud and shell, Foraminifera, 2 dredges, 30 and 40 min.
XXII. 11.iii.29. To East of Snake Reef, 13½ fath., mud with Foraminifera and shells, 2 dredges ½ hour each.
XXIV. 13.iii.29. ¾ mile N.E. Pasco Reef, 16½ fath., hard shell bottom.

LIST OF SPECIES IN THE COLLECTION.

ENTOPROCTA.

**Barentsia gracilis* (Sars).
**Pedicellina compacta*, Harm.
**Loxosoma circulare*, Harm.
**L. pusillum*, Harm.
**L. breve*, Harm.
Loxocalyx, sp.

ECTOPROCTA.

Cyclostomata.

Crisia elongata, M.-E.
Mesonea radians (Lmk.).
Tubulipora pulcherrima (Kirkp.).

Ctenostomata.

Amathia convoluta, Lmx.
**Nolella alta* (Kirkp.).
**Valkeria atlantica* (Busk).
Buskia setigera, Hcks.

Cheilostomata anasca.

**Aetea anguina* (L.).
**A. truncata* (Landsb.).
**Synnotum aegyptiacum* (Aud.).
**Caulibugula dendrograpta* (Waters).
**Beania regularis*, Thorn.
Nellia oculata, Busk.
**Didymozoum triseriale* (Phil.).
Retiflustra cornea (Busk).
**Scrupocellaria maderensis*, Busk.
S. diadema, Busk.
S. delilii (Aud.).
**S. spatulata* (d'Orb.).
Caberea lata, Busk.
**C. boryi* (Aud.).
**C. transversa*, Harm.
Acanthodesia savartii (Aud.).
Chaperia acanthina (Lmx.).
Setosellina coronata (Hcks.).
Cupuladria guineensis (Busk).

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CHEILOSTOMATA ANASCA—*continued.*

Steganoporella buskii, Harm.
Thalamoporella rozieri (Aud.).
Cellaria punctata (Busk).

CHEILOSTOMATA ASCOPHORA.

Hippopodina feegeensis (Busk).
Lepralia montferrandii (Aud.).
**Schizomavella lata* (MacG.).
S. australis (Hasw.).
Emballotheca, sp.
**Stylopoma schizostoma* (MacG.).
**S. viride* (Thorn.).
**Hippothoa distans*, MacG.
Mastigophora pesanseris (Smitt).
**Trypostega venusta* (Norm.).
**Microporella ciliata* (Pall.).
M. malusii (Aud.).
M. mutabilis, sp. n.
**Smittina signata* (Waters).
**S. obstructa* (Waters).

CHEILOSTOMATA ASCOPHORA—*continued.*

**S. acaroensis*, Levins.
**Phylactella geometrica*, Kirkp.
Ciglisula areolata, Kirkp.
**C. cautium*, sp. n.
Petralia chuakensis, Waters.
P. vultur var. *serrata*, Living.
**P. litoralis*, Living. MS., sp. n.
Rhynchozoon longirostre (Hcks.).
Retepora graeffei (Kirch.).
R. monilifera var. *munita*, Hcks.
**R. monilifera*, var. *benemunita* (Busk MS.), var. n.
R. tubulata, Busk.
**Holoporella mamillata* (Busk).
H. fusca (Busk).
**H. intermedia* (MacG.).
H. tridenticulata (Busk).
**Catenaria lafontii* (Aud.).
Vittaticella elegans (Busk).

The species marked with an asterisk are additions to the lists of Queensland Polyzoa published by Livingstone (1926, 1927). Some of them have, however, been recorded from Torres Straits by Busk and Kirkpatrick, and *Barentsia gracilis* was recorded from Queensland by Waters.

ENTOPROCTA.

The number of clearly distinguished species of Australian Entoprocta is small, and it may be useful to give a list with references to the Australian records :

Pedicellina whiteleggii, Johnston and Walker, 1917, p. 60, = *P. cernua*, Whitelegge, 1889, p. 293.

Pedicellina cernua, Pallas, Kirkpatrick, 1888*b*, p. 21. This specimen from Port Phillip (B.M. 88.5.17.24) consists of three small individuals with short, much contracted stalks. In the characters by which *P. whiteleggii* is supposed to be distinguished from *P. cernua* it resembles the latter, having long spines, which are absent from the distal extremity of the stalk and from the calyx and are not conspicuously swollen at the base.

Pedicellinopsis fruticosa, Hincks, 1884*a*, p. 364. Johnston and Walker (1917, p. 62) give a list of subsequent records of this species.

Barentsia gracilis, Sars, Kirkpatrick, 1888*b*, p. 21 (see below, p. 402).

Barentsia laxa, Kirkpatrick, 1890*a*, p. 624.

In addition there are seven records of unnamed *Loxosoma* and two of *Pedicellina*. The latter were found by Goldstein (1880, p. 44) on *Retepora* and by Macgillivray (1887*b*, p. 221), both on the coasts of Victoria.

Two species of *Loxosoma* were found at Shark's Bay, W. Australia, by Macdonald (1877, p. 211), who took them to be spermatophores of the leeches to which they were attached. Goddard (1910, p. 725) rediscovered one of them, but apparently the calyx is deciduous, and with only the stalk known, the form remains undefined. Macdonald's figures would not be recognized even as representing Entoprocta.

Whitelegge (1889, p. 293) records a *Loxosoma* on the Sipunculid, *Phascolosoma australe*, but without description, and the form has not been rediscovered.

Haswell (1892, p. 330) found a *Loxosoma* on the long setae of the Polychaet *Coppingeria longisetosa*, Haswell, at Port Molle, but did not describe it. His figure (pl. xxvi, fig. 1) gives the appearance of the whole worm with the *Loxosoma* attached. I have found specimens in the same position on the same species of worm from the type-locality (B.M. 32.2.1.1) which may be assumed to be Haswell's species. It is near to *L. sluiteri*, Harmer (1915, p. 9), with which it agrees in size and general shape, in the number of tentacles, and in the absence of lateral lobes to the stomach and of cirri and lateral expansions on the calyx. It differs in not having the rather conspicuous cuticle of *L. sluiteri*. Buds are not common, but specimens with one or occasionally two have been seen. The vestibule frequently contains two embryos.

Waters (1904, p. 100) mentions, without description, a *Loxosoma* from Lizard Island, Queensland. The Manchester Museum has kindly lent me the slides of these specimens, showing four whole individuals and one in section attached to a plant stem. The species agrees with *L. circulare*, Harmer (1915, p. 16), in the stomach, gonads, embryos and buds and in the shape of the calyx. Its tentacles cannot be counted. Its average dimensions are: width calyx 218μ, length calyx 305μ, length stalk 305μ. It is thus larger than typical *L. circulare*. The dimensions of the larger " Siboga " specimens (358B) tentatively referred to that species lie between the extremes found in those from Lizard Island.

Finally there is the species from Port Phillip found by Harmer (1915, p. 5) on *Amathia wilsoni*. The smallest specimen measured agrees in size with the largest Barrier Reef *Loxocalyx*, but most are larger, being a little larger than *Loxosoma crassicauda*, Kirkpatrick (discussed below under *Loxocalyx*, sp.). The species on *Amathia* resembles that species in its thick stalk with longitudinal fibres and large cells, but the tentacles are more numerous, probably about 14, and no external sense-organs can be detected.

There are six species of Entoprocta in the Barrier Reef collection. The well-known *Barentsia gracilis* needs no further mention. The small size and wide difference of host of the other five makes it unlikely that they are identical with any of those dismissed above as unrecognizable, and none of them can be related to any of the unnamed Australian forms of which I have examined specimens, unless, when the range of variation of *Loxosoma circulare* is better known, Waters's *Loxosoma* from Queensland should prove to belong to that species.

Barentsia gracilis (Sars).

Pedicellina gracilis, Sars, 1835, p. 6, pl. i, figs. 2*a*, *b*.

Barentsia gracilis, Waters, 1904, p. 100; Ritchie, 1911, p. 840, pl. xlvii, figs. 5–7 (synonymy); Harmer, 1915, p. 27, pl. ii, fig. 12 (references); Annandale, 1922, p. 150; Hastings, 1927, p. 351.

Occurrence.—N.E. Low Is.; St. II, IX.

Distribution.—Queensland, New Zealand, Malaya, India, Red Sea, Mediterranean, Europe, N. Atlantic, Arctic.

Ehlers (1890, p. 143) thought that the description of *Ascopodaria gracilis* by Kirkpatrick (1888*b*, p. 21) might refer to *P. fruticosa*, Hincks, and not to *P. gracilis*, Sars. The only special resemblance to *P. fruticosa* mentioned by Kirkpatrick is the pointed end to the chitinous part of the stalk. As noticed by Harmer (1915, p. 28, footnote), this cannot be seen in Kirkpatrick's specimens. In some individuals the chitinous part does end abruptly at a little distance from the calyx, but the opening is not oblique. In its very much smaller size and finer stolon and the absence of pores in the cuticle of the stalk, Kirkpatrick's specimens resemble *B. gracilis* and are unmistakably distinct from *P. fruticosa*.

Pedicellina compacta, Harmer.

Pedicellina compacta, Harmer, 1915, p. 24, pl. ii, figs. 13, 14.

Occurence.—St. XII on *Caberea boryi*.

Distribution.—Aru Islands.

This specimen consists of one small individual and two buds connected to it by stolons, but the agreement with Harmer's description and paratype specimen leaves no doubt of their identity. The specimen is immature. Its dimensions are less than those given for adult individuals, but many of the younger individuals on the paratype slide are the same size. The rectum is recumbent. The calyx bears a number of short filamentous processes. At least four were detected in rolling the specimen over before mounting. Similar processes can be seen on the paratypes.

Loxosoma circulare, Harmer.

Loxosoma circulare, Harmer, 1915, p. 16, pl. i, figs. 14–16.

Occurrence.—St. II on *Retepora monilifera* var. *munita*.

Distribution.—Malaya.

Only a few specimens of this *Loxosoma* have been found in the Barrier Reef Collections, and it has not been possible to count their tentacles. There are certainly not more than 12. In size and shape the animals agree very closely with the type, but the calyx may be a little narrower. There may be two or three pairs of tactile processes and, as in some of the type-specimens, these spring from a narrow expansion of the body-wall, suggestive of that of *L. velatum*, Harmer, but much narrower and not continued on the stalk. The stalk bears a few irregularly distributed lateral processes (*cf.* Harmer, fig. 14). No individual has been seen with more than one bud. The structure of the genital organs cannot be made out.

Although some characters are uncertain, and others are not in complete agreement with those of *L. circulare*, I think the agreement is sufficiently close to justify the identification of the Barrier Reef specimens with that species.

As explained above (p. 402), the *Loxosoma* from Queensland mentioned by Waters (1904, p. 100) is closely allied to *L. circulare*.

Loxosoma pusillum, Harmer.

Loxosoma pusillum, Harmer, 1915, p. 16, pl. i, figs. 19, 20.

Occurrence.—St. II on *Retepora monilifera* var. *benemunita*.

Distribution.—Malaya.

Loxosoma breve, Harmer.

Loxosoma breve, Harmer, 1915, p. 19, pl. i, figs. 29–31.

Occurrence.—St. XXVIII on *Schizomavella australis*.

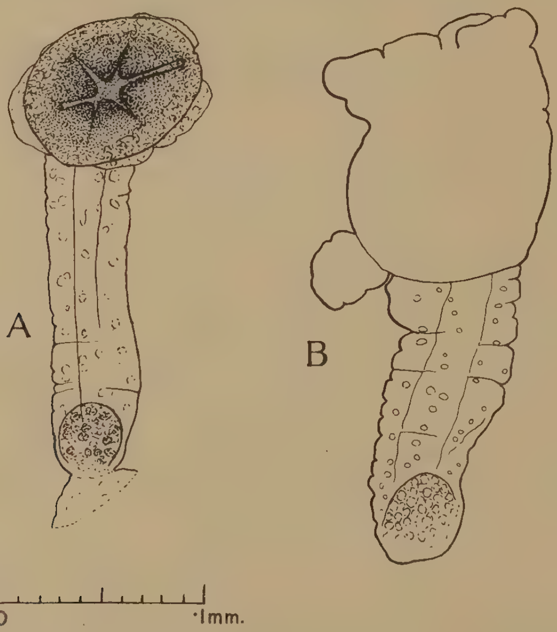
Distribution.—New Guinea.

A single individual of this species was attached to the outer surface of the operculum of its host, with its oral surface directed towards the opening of the compensation sac, *i. e.* proximally.

Loxocalyx, sp. (Text-fig. 1.)

Occurrence.—W. Low Is., 8 fath., on the Polychaet *Sthenelais malayana*, Horst (Monro, 1931, p. 8).

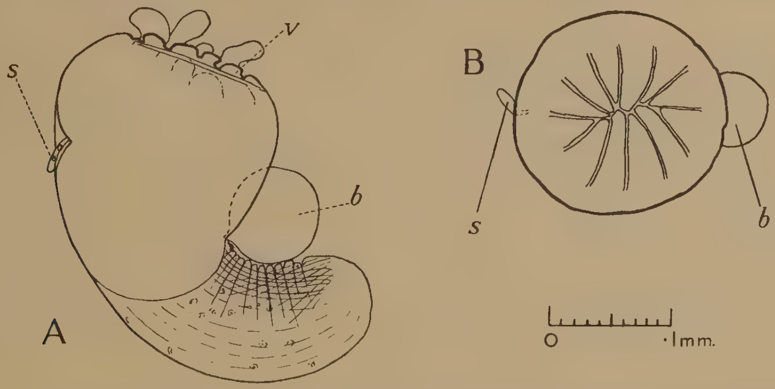
Description.—The calyx is, on the average, ·14 mm. long and ·09 mm. wide. The stalk is very little narrower than the calyx, and in its somewhat contracted condition, usually about the same length. The calyx of the largest specimen is ·20 × ·14 mm. The lophophore is only slightly oblique (Text-fig. 1, B), and bears, where it has been possible to count them accurately, 6 stout tentacles (Text-fig. 1, A). No external sensory processes have been seen. The anal papilla bears a tuft of long cilia and frequently projects beyond the inturned tentacles. The stalk has a few longitudinal fibres, and between them single rows of large, unevenly-spaced cells. The foot-gland is more or less spherical and below it the stalk contracts and then spreads out to a disc-like foot, without wings (Text-fig. 1, A).



Text-fig. 1.—*Loxocalyx*, sp. Left side. A, With the calyx bent at right angles to the stalk, showing tentacles. B, Unbent, foot incomplete.

Remarks.—The presence of a foot-gland puts this species in *Loxocalyx*, although the duct has not been detected and the foot is not alate. Harmer (1915, p. 7) gives a list of the species of *Loxocalyx*, six being Neapolitan, one Malayan and one common to these two localities. The Barrier Reef specimens differ from all of them in their small size, in the small number of their tentacles, and in the very slight obliquity of the lophophore. The possibility must not be overlooked, however, that they are immature. The genital organs have not been observed, and the buds are at a very early stage of development. If so the animals might be expected to increase in size, and perhaps form more tentacles, and it is possible that the lophophore might become more oblique. *L. lineatus*, Harmer (1915, p. 6), which is the nearest *Loxocalyx* geographically, has a long slender stalk, and differs in the shape of the foot and in having membranous expansions on the calyx. It thus seems probable that the Barrier Reef specimens represent a new species, but while the possibility remains that they are juvenile specimens, I prefer not to give them a name.

The specimens from the Tizard Bank (B.M. 89.8.21.70), tentatively identified by Kirkpatrick (1890*b*, p. 17) with *Loxosoma crassicauda*, Salensky (1877, p. 2), have been remounted, and show some resemblance to the Barrier Reef specimens in their general shape (Text-fig. 2, A), and in the structure of the stalk, which is thick, and has longitudinal muscles and large cells in between, but the longitudinal bands are more numerous, and no foot-glands can be detected. Three of the specimens are larger than the Barrier Reef *Loxocalyx;* the fourth has almost exactly the average dimensions of that form. They appear to have more tentacles, though not as many as *L. crassicauda*, Salensky. They cannot be counted with any certainty. Remounting has disclosed the presence of a characteristic organ, presumably a sense-organ. It takes the form of a slender, clavate streamer of protoplasm containing one or two nuclei (Text-fig. 2A). One of these processes can be seen in each specimen. The edge of the velum is lobed. Better preserved material, which I believe to belong to this species, is growing on a shell collected by Dr. Crossland in Papeete Harbour, Tahiti (B.M. 29.4.25.5). There are twelve tentacles and a single, sensory process on the anal radius (Text-fig. 2, B). Owing to the smaller number of tentacles, the structure of the sense-organ and the rather less oblique lophopore, *L. crassicauda*, Kirkpatrick, must probably be distinguished from *L. crassicauda*, Salensky.



Text-fig. 2.—*Loxosoma crassicauda*, Kirkpatrick (*non* Salensky). A, One of Kirkpatrick's specimens. B, Distal view of a specimen from Tahiti. *b.*, Bud. *s.*, Sense organ. *v.*, Velum.

ECTOPROCTA.

Crisia elongata, Milne-Edwards.

Crisia elongata, Milne-Edwards, 1838, p. 203, pl. vii, fig. 2; Harmer, 1915, p. 96, pl. viii, figs. 1–8 (synonymy); Marcus, 1921*a*, p. 29; 1921*b*, p. 19; O'Donoghue, 1924, p. 24; Livingstone, 1927, p. 67.

Occurrence.—N.E. Low Is.; off N. Anchorage; St. II, XII.

Distribution.—Australia, Oceania, Malaya, Indian Ocean, Mediterranean.

All these specimens agree with Harmer's description of young colonies of this species, but as there are no ovicells the identification is uncertain.

Tubulipora pulcherrima (Kirkpatrick).

Idmonea pulcherrima, Kirkpatrick, 1890*b*, p. 22, pl. iv, figs. 6–6*b*.
Tubulipora pulcherrima, Harmer, 1915, p. 129, pl. ix, figs. 1–5 (synonymy).
? *Diaperoecia radicata*, Canu and Bassler, 1929, p. 538, pl. lxxxii, figs. 1–5.

Occurrence.—N.E. Low Is.; W. Low Is., 6 fath.; St. II.

Distribution.—New South Wales, Loyalty Is., China Sea., Malaya, Manaar, E. Africa.

The specimen from N.E. Low Is. is small, but shows ovicells, cross-connections and a rooting-column. The ooeciostomes are broken, but the complete agreement in other characters leaves no doubt of the identity of the specimen with *T. pulcherrima*. The material from other stations is fragmentary, but there is no reason to suppose that it does not belong to the same species.

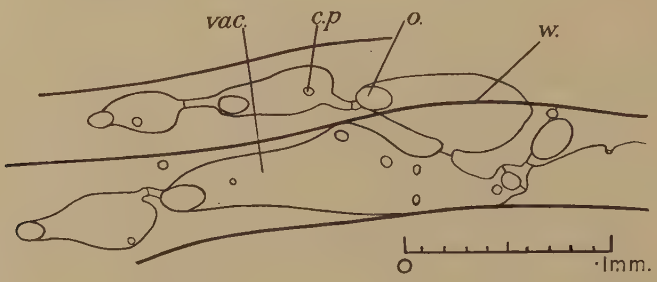
Mesonea radians (Lamarck). (Text-fig. 3.)

Retepora radians, Lamarck, 1816, p. 183.
Crisina radians, Harmer, 1915, p. 139, pl. x, figs. 6–8 (synonymy); Livingstone, 1927, p. 68.
Mesonea radians, Canu and Bassler, 1920, p. 762, text-fig. 250.

Occurrence.—N.E. Low Is.; off N. Anchorage; St. XI.

Distribution.—Australia, Oceania, Malaya, Indian Ocean.

The zoarium has a frontal layer of long tubular zooecia and a basal layer of kenozooecia. The cavities of the kenozooecia are much smaller than those of the autozooecia and, owing to the very thick walls, have the appearance of chambers imbedded in a solid calcareous mass. They are arranged in longitudinal series, and each opens to the exterior by an oval orifice. These are the pores in the dorsal sulci frequently described and figured in *C. radians* (*e. g.* Canu and Bassler, 1920, text-fig. 250, E). Each kenozooecium has a tubular peristome leading inwards from the orifice, at right angles to the dorsal surface of the branch. This opens into a more or less oval chamber placed longitudinally. Each kenozooecium is thus bent at a right angle. The chamber is connected by tubes with its proximal and distal neighbours in the longitudinal series of kenozooecia, and by one or more pores with the adjacent autozooecium (Text-fig. 3). Occasionally the series branch, two kenozooecia springing from the distal end of one.



Text-fig. 3.—*Mesonea radians* (Lmk.). Part of the basal layer seen by transmitted light after destruction of the autozooecia. *c.p.*, Communication pore. *o.*, Orifice of vacuole. *vac.*, Vacuole. *w.*, Lateral wall of autozooecium.

Canu and Bassler (1920, p. 762) described tergopores in *Mesonea*, but later (1929, p. 549) stated that this was an error. Prof. Canu tells me (in a letter) that the word "vacuoles" should be substituted for "tergopores" in the definition of *Mesonea*. In their definitions of the different types of accessory tube, Canu and Bassler (1920, p. 645) state that adventitious tubes (*i. e.* mesopores, and vacuoles) only arise on the frontal surface, but they have subsequently written of dorsal or posterior vacuoles (*e. g. Reteporidea*, 1922, p. 129; *Mesonea simplex*, 1929, p. 549), so it may be assumed that they do not now regard the frontal or dorsal position as important.

Amathia convoluta, Lamouroux.

Amathia convoluta, Lamouroux, 1816, p. 160; Harmer, 1915, p. 64, pl. v, figs. 1–5.

OCCURRENCE.—N.E. Low Is.; St. II.

DISTRIBUTION.—E. Australia, Malaya.

This specimen has divided spirals of the *semispiralis* type.

Nolella alta (Kirkpatrick).

Cylindroecium altum, Kirkpatrick, 1888*b*, p. 19, pl. ii, figs. 7, 7*a*; Whitelegge, 1889, p. 293; Harmer, 1915, p. 57 (footnote).

OCCURRENCE.—St. XII.

DISTRIBUTION.—Port Phillip, Amoy (B.M. 27.8.11.18).

This fragment of a branching *Nolella* consists of three zooecia, and corresponds to Kirkpatrick's description of *Cylindroecium altum*. The larger, more profusely branched specimen from Amoy appears to belong to the same species. The smaller number of tentacles (about 10) together with the branched zooecia distinguishes *N. alta* from *N. papuensis*, in which the zooecia are unbranched and there are about 18 tentacles. The European *Anguinella palmata*, Van Beneden (see Hincks, 1880, p. 539), has 10 tentacles, and appears to be very closely allied to the present species. In specimens in the British Museum the zooecia are thicker and the branching is more profuse.

Valkeria atlantica (Busk).

Farrella atlantica, Busk, 1886, p. 37, pl. vii, figs. 3–3*g*.
Valkeria atlantica, Harmer, 1915, p. 73, pl. vi, figs. 5–12 (references); Marcus, 1921*b*, p. 20.

OCCURRENCE.—St. II, XII, XXII.

DISTRIBUTION.—Malaya, Indian Ocean, Brazil.

Buskia setigera, Hincks.

Buskia setigera, Hincks, 1887, p. 127, pl. xii, figs. 9–13; Harmer, 1915, p. 87, pl. v, figs. 8–10 (references); Hastings, 1927, p. 351; Livingstone, 1927, p. 67.

OCCURRENCE.—N.E. Low Is.; St. XII.

DISTRIBUTION.—Queensland, Malaya, China Sea, Indian Ocean.

Aetea anguina (Linnaeus).

Sertularia anguina, Linnaeus, 1758, p. 816.
Aetea anguina, Harmer, 1926, p. 194, pl. xiii, figs. 3, 4 (synonymy); Hastings, 1930*a*, p. 702.

Occurrence.—N.E. Low Is.; St. XII.
Distribution.—Cosmopolitan.

Aetea truncata (Landsborough).

Anguinaris truncata, Landsborough, 1852, p. 288, pl. xvi, figs. 57, 57*.
Aetea truncata, Harmer, 1926, p. 196, pl. xiii, figs. 5–7 (synonymy); Hastings, 1930*a*, p. 702.

Occurrence.—N.E. Low Is.; St. VIII.
Distribution.—Cosmopolitan.

Synnotum aegyptiacum (Audouin).

Loricaria aegyptiaca, Audouin, 1826, p. 243; Savigny, pl. xiii, figs. 4^1–4^5.
Synnotum aegyptiacum, Harmer, 1926, p. 398, pl. xxvii, figs. 3, 4 (synonymy); Osburn, 1927, p. 126; Hastings, 1930*a*, p. 702.

Occurrence.—St. XII, XXII.
Distribution.—W. Atlantic, Mediterranean, Indian Ocean, Malaya, Japan, Victoria, E. Pacific.

Caulibugula dendrograpta (Waters). (Text-fig. 4, a.)

Stirparia dendrograpta, Waters, 1913, p. 470, pl. lxvi, figs. 4–9.
Caulibugula dendrograpta, Harmer, 1926, p. 459, pl. xxxiii, figs. 1–4.

Occurrence.—St. XXI.
Distribution.—Malaya, Zanzibar, Port Phillip.*

This small specimen is part of a young colony. The turbinate ancestrula (Text-fig. 4, a) is attached to the substratum by a slightly spreading base, and by a rootlet springing from the frontal surface near the base. The opesia is oval, and has eight spines on its lateral and proximal borders, but none distally. The ancestrula gives rise to three kenozooecia of typical form, one distal and two lateral, and to the first fan. The primary zooecium of the fan has spines all round the opesia, and arises on the basal surface of the end of the ancestrula, just proximally to the median kenozooecium. This kenozooecium gives rise distally to a series of kenozooecia which may be regarded as the main stalk of the colony, from which fans and kenozooecia are budded laterally. The specimen agrees closely with Harmer's description of *C. dendrograpta*, but there is an avicularium on nearly every zooecium, except the first of a fan and the axillary zooecium at a bifurcation.

From St. XII there is the base of a young colony of another species of *Caulibugula* (Text-fig. 4, b). It resembles *C. zanzibarensis*, Waters (1913, p. 469), in many ways, but, owing to the small size of the specimen and the absence of ovicells and stem-vesicles, the species cannot be determined with certainty. The zooecia resemble those of *C. zanzibarensis* in shape and have a proximal avicularium of the kind found in that species, but no spine on the inner distal angle of the opesia. There may be two on the outer angle or none. The ancestrula and the zooecium and kenozooecia budded from it are arranged in the same way as those of *C. dendrograpta*. A kenozooecium appears to have been formed by constriction from the proximal part of the ancestrula, as described in *C. caliculata* by Levinsen (1909, p. 102, pl. iii, figs. 1*d*, *e*). The ancestrula and first zooecium differ in the two species in the same way as do the adult zooecia, the opesia being more or less oval in *C. dendrograpta* and almost triangular in the unnamed species.

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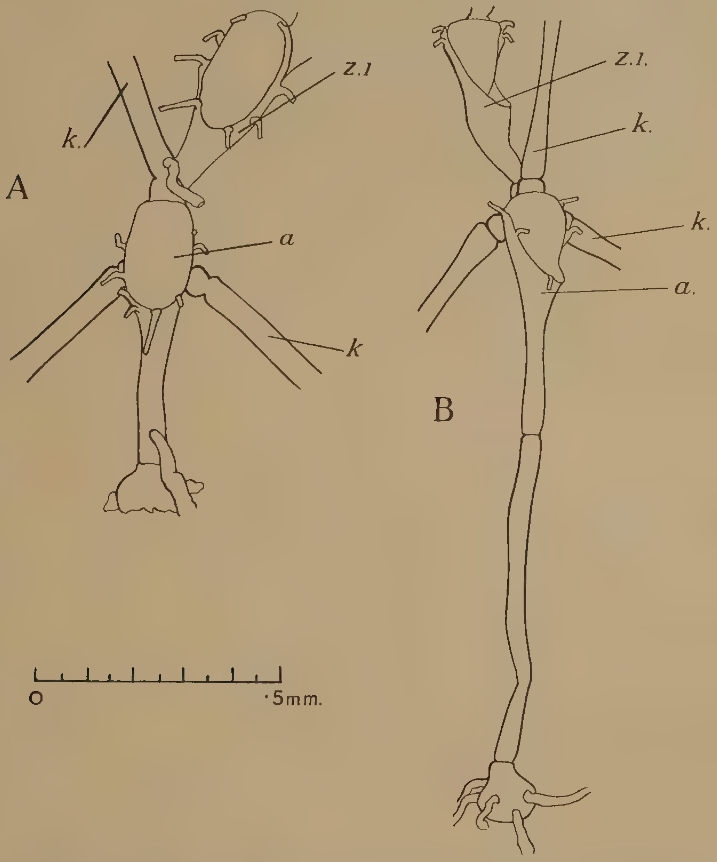
* Waters (1913, p. 471) states that there is a specimen of this species from Port Phillip in the British Museum. One unnamed *Stirparia* (B.M. 15.10.20.5), from an unknown locality, which was sent by Mr. Waters with some Polyzoa from Zanzibar, proves to be *S. dendrograpta*. Unless this is the specimen from Port Phillip, no specimen from that locality is now in the collection.



Text-fig. 4.—*Caulibugula*. Base of colony. A, *C. dendrograpta*. B, *Caulibugula*, sp., from St. XII. *a.*, Ancestrula. *k.*, Kenozooecium. *z.*^{1}., First zooecium of first fan.

Beania regularis, Thornely.

Beania regularis, Thornely, 1916, p. 161, text-fig. 6 ; Harmer, 1926, p. 418, pl. xxviii, figs. 11, 12 (synonymy).

Occurrence.—N.E. Low Is. ; St. IX, XII.

Distribution.—Holothuria Bank, N.W. Australia (B.M. 92.1.28.35) ; Malaya ; Indian Ocean.

Nellia oculata, Busk.

Nellia oculata, Busk, 1852*b*, p. 18; Harmer, 1926, p. 240, pl. xiv, fig. 18, text-figs. 3B, D, 4A, B (synonymy); Livingstone, 1927, p. 52; Osburn, 1927, p. 125; Canu and Bassler, 1928*b*, p. 26.

Occurrence.—W. Low Is., 6 fath.; St. IX, XII, XXI, XXII.

Distribution.—Australia, Malaya, Amoy (B.M. 27.8.11.15), Indian Ocean, E. Atlantic.

A specimen of the typical form is in a collection sent to the British Museum from Amoy in 1926 by Dr. C. Ping, and this collection also includes var. *quadrilatera*. The Barrier Reef collection only contains the typical form.

From St. XXI there are several small complete colonies attached to discoidal Foraminifera from the surface of a sponge. The Polyzoa are slung by a number of rootlets, the proximal zooecium not being in contact with the substratum.

Didymozoum triseriale (Philipps).

Didymia triserialis, Philipps, 1899, p. 442, pl. xlii, figs. 2, 2*a*.
Didymozoum triseriale, Harmer, 1926, p. 407, pl. xix, fig. 1.

Occurrence.—St. XXII.

Distribution.—Malaya, Oceania.

Retiflustra cornea (Busk).

Retepora cornea, Busk, 1852*a*, p. 380.
Retiflustra cornea, Harmer, 1926, p. 250, pl. xv, fig. 3, text-fig. 8 (synonymy).

Occurrence.—St. VIII.

Distribution.—N. Australia, Malaya (Aru Is., New Guinea).

Scrupocellaria maderensis, Busk.

Scrupocellaria maderensis, Busk, 1860, p. 280; Harmer, 1926, p. 372, pl. xxv, figs. 16–19 (synonymy).

Occurrence.—N.E. Low Is.

Distribution.—Malaya, Japan, Indian Ocean, E. Atlantic, W. Atlantic (B.M. 31.12.19.5, Tortugas).

Scrupocellaria diadema, Busk.

Scrupocellaria diadema, Busk, 1852*a*, p. 370; Harmer, 1926, p. 375, pl. xxv, figs. 20–25 (synonymy); Livingstone, 1927, p. 52; Canu and Bassler, 1929, p. 211, pl. ix, figs. 4, 5.

Occurrence.—N.E. Low Is.; St. II, VIII, XII.

Distribution.—Australia, Malaya, Japan, Indian Ocean.

Scrupocellaria delilii (Audouin).

Crisia delilii, Audouin, 1826, p. 242; Savigny, pl. xii, figs. 3^1–3^5.
Scrupocellaria delilii, Harmer, 1926, p. 370, pl. xxv, figs. 12–15 (synonymy).
Scrupocellaria macandrei, Livingstone, 1927, p. 53.

Occurrence.—W. Low Is., 6 fath.; St. IX, XII.

Distribution.—Australia, Malaya, Japan, Red Sea, Mediterranean, Madeira.

Scrupocellaria spatulata (d'Orbigny).

Cellularia spatulata, d'Orbigny, 1851, p. 50.
Scrupocellaria spatulata, Harmer, 1926, p. 382, pl. xxvi, figs. 1–10 (synonymy).
Scrupocellaria cervicornis (pars), Livingstone, 1927, p. 53.

OCCURRENCE.—St. XII.

DISTRIBUTION.—E. Australia, Malaya, Indian Ocean, Florida.

Two small pieces agree with Harmer's description of *S. spatulata* in the form of the zooecia, the number and position of spines, the form and position of vibracula and scuta and in the barbed rootlets. Ovicells, frontal avicularia and enlarged marginal avicularia are absent, but the agreement in the other characters is so close that the identification is made with fair confidence. One piece includes the ancestrula, which has the form frequently found in cellularine Polyzoa (*e. g.* Busk, 1852*b*, pl. xxiii, fig. 1; Hastings, 1930*a*, pl. i, figs. 1 and 4) and has eleven spines evenly distributed round the opesia.

Caberea lata, Busk.

Caberea lata, Busk, 1852*a*, p. 378; Harmer, 1926, p. 360, pl. xxiv, figs. 7–9 (synonymy); Livingstone, 1927, p. 53.

OCCURRENCE.—St. XII.

DISTRIBUTION.—Queensland, Malaya, Japan, Indian Ocean.

Caberea boryi (Audouin).

Crisia boryi, Audouin, 1826, p. 242; Savigny, pl. xii, figs. 4^1–4^6.
Caberea boryi, Harmer, 1926, p. 362, pl. xxiv, figs. 13–15.

OCCURRENCE.—St. IX, XII.

DISTRIBUTION.—Malaya, Japan, Indian Ocean, Mediterranean.

Caberea transversa, Harmer.

Caberea transversa, Harmer, 1926, p. 363, pl. xxiv, figs. 5, 10; Canu and Bassler, 1929, p. 214, pl. xxxviii, figs. 9, 10.

OCCURRENCE.—St. XII.

DISTRIBUTION.—Malaya.

Harmer mentions the relationship of his species to the Australian *C. glabra*, Macgillivray (1886, p. 129), which differs in its large spines and frontal avicularia. In specimens of *C. glabra* in the British Museum the large spines are not present on all parts of the colony. It would not be easy to distinguish such spineless parts from *C. transversa*, and the occurrence of both species on the Australian coast suggests that they may be synonymous.

Acanthodesia savartii (Audouin).

Flustra savartii, Audouin, 1826, p. 240; Savigny, pl. x, figs. 10^1, 10^2.
Acanthodesia savartii, Harmer, 1926, p. 213, pl. xiii, figs. 8, 13, 14, 16 (synonymy); Livingstone, 1927, p. 54; Canu and Bassler, 1929, p. 66, pl. i, figs. 1–5.

OCCURRENCE.—Low Is., 12 fath.; St. XIII.

DISTRIBUTION.—Australia, Malaya, Japan, Indian Ocean, Morocco, Florida.

Chaperia acanthina (Lamouroux).

Flustra acanthina, Lamouroux, 1825, p. 605, pl. lxxxix, figs. 1, 2.
Chaperia acanthina, Harmer, 1926, p. 229, pl. xiv, figs. 9, 10 (synonymy); Livingstone, 1927, p. 54; 1929, p. 100; Canu and Bassler, 1929, p. 472, text-figs. 201D–G, 202.

OCCURRENCE.—St. II.

DISTRIBUTION.—Australia, New Zealand, Malaya, Indian Ocean, Falkland Islands.

This young colony consists of the ancestrula and first three zoecia, but they show the characters of the species and can be identified with fair confidence.

Setosellina coronata (Hincks).

Membranipora coronata, Hincks, 1881*b*, p. 147, pl. x, fig. 1.
Setosellina coronata, Harmer, 1926, p. 265, pl. xvi, figs. 2–4 (synonymy).
Ellisina coronata, Livingstone, 1927, p. 54.

OCCURRENCE.—St. XXII.

DISTRIBUTION.—Australia, Malaya, Indian Ocean.

The specimen was dead when collected and only the calcareous parts remain. These are, however, sufficiently characteristic for determination.

Cupuladria guineensis (Busk).

Cupularia guineensis, Busk, 1854, p. 98, pl. cxiv.
Cupuladria guineensis, Harmer, 1926, p. 266, pl. xvi, figs. 5–7, text-fig. 9 (synonymy).
Cupuladria guineensis, *intermedia* and *brevipora*, Canu and Bassler, 1929, p. 74.

OCCURRENCE.—Low Is., 12 fath.

DISTRIBUTION.—Australia, Malaya.

Canu and Bassler (1929, p. 74) introduce new names for species identified as *Cupuladria guineensis*, Busk, as follows:

C. guineensis, Busk, 1854, type of the species.
,, ,, 1884 = *C. intermedia*, Canu and Bassler, 1929.
,, Harmer, 1926 = *C. brevipora*, ,, ,,

Their conclusions are based on the published figures and descriptions, some of which are misleading, as examination of the original specimens in the British Museum shows. Busk's figure of the holotype (1854, pl. cxiv, fig. 3) gives an impression of a tuberose basal surface, and for this reason Canu and Bassler regard the later specimens, which have a pitted basal surface, as distinct. The specimen figured by Busk has, however, a pitted basal surface. Some of the pits have slightly raised borders, but the majority form no projection at all. All three specimens thus agree in having a pitted basal surface. Canu and Bassler would further distinguish *C. guineensis*, Harmer, 1926, from the others on the shape of the opesia. The fact is, however, that Harmer gave the first adequate account of the variation in the form of the opesia, and that the various shapes mentioned by him are found in all the specimens.

Canu and Bassler maintain the separation of *C. stellata* (Busk, 1854). Busk distinguished the species by the serrate edge of the colony and the narrow smooth cryptocyst. Each serration consists of the distal part of one zooecium with its distal vibraculum. These do not project any more than in other species of *Cupuladria*, but owing to the small size of the colonies they are more conspicuous. The stellate appearance of the colony can thus be regarded as characteristic of young colonies. The cryptocyst is rather narrow in the type-specimen and descends steeply. It is tuberculate, as in *C. guineensis*. The basal surface of the figured type-specimen is not smooth, as in Busk's figure, but roughened and pitted. It has not, however, the conspicuously tuberose surface of *C. dentifera*, Canu and Bassler (1929, p. 75). The differences between *C. guineensis* and *C. stellata* are thus slight, and I agree with Marcus (1921*b*, p. 8) and Harmer (1926, p. 266) that *C. stellata* is a young colony of *C. guineensis*.

Steganoporella buskii, Harmer.

Steganoporella buskii, Harmer, 1900, p. 272, pl. xii, fig. 13; pl. xiii, figs. 33–35; 1926, p. 279 (references); Livingstone, 1927, p. 56.

OCCURRENCE.—Low Isles (shore).

DISTRIBUTION.—Australia, Malaya, Indian Ocean.

These specimens are encrusting. There is slight variation in the sclerites of the B-opercula, their parallel portions sometimes being shorter than in that figured by Harmer, but the majority are typical. Similar slight variability is found in most of the specimens in the British Museum identified with this species by Harmer.

Thalamoporella rozieri (Audouin).

Flustra ? rozieri, Audouin, 1826, p. 239; Savigny, pl. viii, figs. 9¹, 9².
Thalamoporella rozieri, Harmer, 1926, p. 292, pl. xix, figs. 3–13 (synonymy); Livingstone, 1927, p. 56.

OCCURRENCE.—Batt Reef.

DISTRIBUTION.—Australia, Malaya, Indian Ocean, Cape Verde Is., S.W. England.

Cellaria punctata (Busk).

Salicornaria punctata, Busk, 1852*a*, p. 366.
Cellaria punctata, Harmer, 1926, p. 337, pl. xxi, figs. 14–16, text-fig. 13*a* (synonymy).
Cellaria gracilis, Livingstone, 1927, p. 57.

OCCURRENCE.—St. II.

DISTRIBUTION.—E. and N.E. Australia, Malaya, Indian Ocean.

Hippopodina feegeensis (Busk).

Lepralia feegeensis, Busk, 1884, p. 144, pl. xxii, fig. 9; Livingstone, 1926*a*, p. 94.
Lepralia feegensis, Waters, 1913, p. 514, pl. lxx, figs. 21, 22 (references).
Cosciniopsis fallax, Canu and Bassler, 1929, p. 276, pl. xxviii, fig. 7, text-fig. 113A–D.
? not *Hippopodina feegeensis*, Levinsen, 1909, pl. xxiv, fig. 3*a*, *b*.
? not *Hippopodina feegensis*, Hastings, 1930*a*, p. 729.

OCCURRENCE.—St. XIII.

DISTRIBUTION.—Australia, Malaya, Indian Ocean.

Busk described the ovicells of this species as inapparent, and this has led some authors to the belief that the true *H. feegeensis* has endozooecial ovicells. Canu and Bassler introduced the name *Cosciniopsis fallax* for the supposedly distinct form with large ovicells. Busk's type-specimen has, however, large ovicells exactly like those figured in *C. fallax*, and there can be no doubt that *C. fallax* is a synonym of *H. feegeensis*.

Since *L. feegeensis*, Busk, is the genotype of *Hippopodina*, Levinsen (1909, p. 353), the presence of large, hyperstomial ovicells invalidates the expanded definition of the genus given by Canu and Bassler (1920, p. 532).

The specimens from Gorgona (Hastings, 1930*a*) resemble those figured by Levinsen (1909, pl. xxiv, fig. 3*a*, *b*) in the shorter avicularia and smaller, more immersed ovicells; the ovicells being ·4 to ·45 mm. wide and those of the type ·76 mm. Levinsen's specimens came from St. Thomas, W. Indies, and it seems possible that the American form is distinct from the Indo-Pacific one, though Osburn (1927) had specimens with long and short avicularia from Curaçao. The Pliocene specimens from Bocas Island, Panama (Canu and Bassler, 1928*b*, p. 133) appear, however, to be of the typical form.

Lepralia montferrandii (Audouin).

Flustra montferrandii, Audouin, 1826, p. 240; Savigny, pl. ix, figs. 14^1, 14^2.
Lepralia montferrandii, Waters, 1909, p. 171, pl. xvii, figs. 15–18 (synonymy).

Occurrence.—St. XIII.

Distribution.—Queensland, Port Phillip Heads (B.M. 88.11.14.317), Tizard Bank (B.M. 89.8.21.103, 104), Ceylon, Red Sea.

I have examined the specimen from the Red Sea identified with Audouin's species by Waters. It much resembles the Barrier Reef specimen. The orifice of the former is on the average broader in its proximal part, with a straighter lower lip, but there is variation in both specimens. The spatulate avicularium of that from the Red Sea is smaller and more oblique, and the thickened border of the operculum is conspicuous owing to its brown colour. Waters regarded the Queensland species, which is very probably *L. mortoni*, Haswell (1881, p. 40), as identical with that from the Red Sea, and in spite of their slight differences I am inclined to agree with him. Livingstone (1927, p. 63) recorded both species from Queensland.

Thornely (1905, p. 119) recorded *L. mortoni* from Ceylon. Part of her specimen is in the Cambridge Museum and is referable to *L. montferrandii*. The specimen from the same locality identified by Waters (1909, p. 171) with *L. montferrandii* has been lent to me and is a distinct species. As mentioned by Waters, the frontal wall has marginal areolae and a central imperforate area, and the peristome is somewhat raised.

A number of species resembling *L. montferrandii* have been named, and it is uncertain how many of them are really distinct. A specimen from Japan in the Cambridge Museum identified, probably correctly, with *L. acuta*, Ortmann (1889, p. 41), is very similar, but has the proximal end of the oblique spatulate avicularium in the middle of the zooecium, that of *L. montferrandii* being more lateral—a very slight distinction. A specimen of *L. obtusata*, Ortmann (1889, p. 41), from Japan in the Cambridge Museum has all the avicularia obtuse and median. The large, spatulate ones may be longitudinal or very slightly oblique. Other species of this group are *L. anatina* (Canu and Bassler, 1927*b*, p. 26) from Hawaii and *L. granulata* (Canu and Bassler, 1930, p. 29; Hastings, 1930*a*, p. 725) from the Galapagos Islands.

These forms agree in having a uniformly punctured frontal wall, an ovicell uniformly, but rather less closely punctured, a median, backwardly-directed avicularium on most of the zooecia, a more or less round orifice, and (where it has been examined) an operculum with a pair of articular projections (Waters, 1909, pl. xvii, fig. 16; Hastings, 1930*a*, pl. xiii, fig. 83). In these characteristics they agree with *Lepralia galeata*, Busk (1854,* p. 66), the genotype of *Codonella*, a genus introduced by Canu and Bassler (1927*b*, p. 26) for this group of species. The name *Codonella* cannot stand, however, having been used by Haeckel (1873, p. 564) for a genus of Infusoria. Pending the introduction of another name it has seemed convenient to put them into *Lepralia*, used, as proposed by Canu and Bassler (1927, p. 32), as a temporary name for unplaced species.

Comparison of the type-specimen of *L. galeata* with Calvet's description of *L. gemelliporoides* (1904, p. 23) shows that they are synonymous, as maintained by Waters (Calvet, 1904, p. 24). *L. galeata*, Busk (1879, p. 195), from Kerguelen, appears to be distinct, having the central part of the frontal wall imperforate and having marginal areolae, an operculum of a different shape, and a considerably raised avicularium with a larger, more spatulate mandible.

Schizomavella.

Two species in the collection, *S. lata* and *S. australis*, with *S. triangula* (Hincks, 1881*c*, p. 12) and *S. ambita* (Waters, 1889, p. 11), must probably be separated from *Schizoporella*, Hincks (1877, p. 527), genotype *S. unicornis*, Johnston.† Waters (1904, p. 49) defined several groups of Schizoporellid species. He expressed the opinion that the group containing *S. lata*, *S. triangula* and *S. ambita* deserved generic rank, and suggested the use of *Gemellipora*, Smitt (1873, p. 35). According to Canu and Bassler (1928*b*, p. 151) he made *G. glabra* the genotype. As I understand him, his intention was not to select *G. glabra*, which he never mentions, but to point out that if " the first species mentioned by Smitt " (*i. e. G. eburnea*, which he thus clearly regards as the genotype) should be a *Pasythea*, the name *Gemellipora* would be synonymous with *Pasythea*, and not available for Smitt's other species and their congeners. *G. eburnea* is the only species included in the genus by Levinsen (1909, p. 313), and even if the virtual selections of Smitt himself (quoted by Canu and Bassler, 1928, p. 151, footnote) and of Waters are not accepted, Levinsen's selection is valid, and has priority over the selection of *G. glabra* by Canu and Bassler (1920, p. 369). As pointed out by Canu and Bassler (1928*b*, p. 151), Macgillivray (1895, p. 87) and Maplestone (1902, p. 71) both used *Gemellipora*. They did not, however, express an opinion on the genotype. *S. lata*, and its allies do not appear to have any special relationship to *G. eburnea*, and cannot be put in *Gemellipora*.

A glance at the figures of *S. auriculata* (Hassall), reproduced by Canu and Bassler (1920, p. 354, text-figs. 107 F, G), will show that there is not complete agreement as to the shape of the orifice. Examination of the British specimens in the British Museum and comparison with Johnston's figure (1847, pl. liv, fig. 8, which, according to Hassall, 1842, p. 411, was to be furnished by him) and of Hincks (1880, pl. xxix, figs. 3-5), satisfies me that the true *S. auriculata* has an orifice resembling that of the ordinary zooecia of *S. lata* and *S. triangula*. This shape is difficult to define briefly and accurately, but, seeing text-fig. 5 A, the description "roundly triangular," used in this paper, will be readily intelligible.

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* The date 1852 given by Canu and Bassler is that of Vol. I of the British Museum Catalogue, but *L. galeata* is described in Vol. II.

† Waters (1904, p. 49) overlooked Hincks's selection, and assumed that *S. sanguinea* or *S. linearis* included in the genus by Hincks (1879, p. 157) would be the genotype. His *Schizoporella*, s. str., is not, therefore, the group of species to which the name really belongs. He repeats this mistake in 1913 (p. 505).

Canu and Bassler (1920, p. 335) have also overlooked Hincks's selection, but mention *S. unicornis* as the first species described. They introduce *Schizopodrella* with *S. unicornis* as genotype, and propose to use *Schizoporella*, " at least provisionally, for all the species imperfectly studied and classed." The convenience of a miscellaneous genus of this kind is obvious, but the use of a name that has been properly introduced with a well-known species as genotype, and the introduction of another genus with the same genotype cannot be accepted. *Schizoporella* and *Schizopodrella* are therefore regarded as synonymous.

S. triangula and its allies appear to be so closely related to *S. auriculata* (see also p. 418) that, in spite of the opercular dimorphism, they should be regarded as congeneric. They agree in the more or less uniform perforation of the frontal wall and ovicell (the latter sometimes being partially covered by an imperforate crust formed by secondary calcification); in the shape of the orifice of the ordinary zooecium; in the attachments of the occlusor muscles of the operculum, which are near the margin and connected to it by a little sclerite; in the median avicularium just proximal to the orifice. The very different degree of dimorphism found in these species (*e.g.*, the slight dimorphism of *S. lata*) supports the view, already expressed by Waters (1918*b*, p. 99), that dimorphism of the opercula is not a generic character. As *S. auriculata* is the genotype of *Schizomavella*, Canu and Bassler (1917, p. 40), the most satisfactory course seems to be to put *S. triangula* and its allies in this genus. As pointed out by Livingstone (1929, p. 80), the genus *Metroperiella*, Canu and Bassler (1917, p. 40), in which *S. lata* has sometimes been placed, is now merged in *Schizomavella*.

Though all the species of *Schizomavella* here discussed have a roundly triangular orifice, no implication that species with a differently shaped orifice should be excluded is intended.

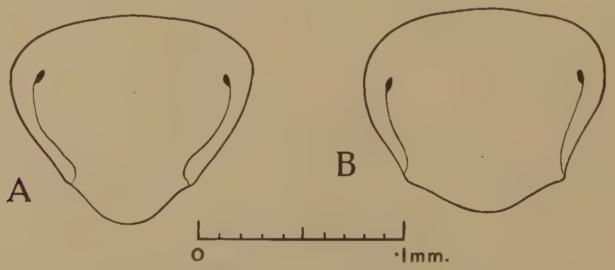
Schizomavella lata (Macgillivray). (Text-fig. 5.)

Schizoporella lata, MacGillivray, 1883, p. 132, pl. i, fig. 7; Waters, 1889, p. 10.
Schizoporella (*Metroperiella*) *lata*, Livingstone, 1929, p. 79 (references).
? *Schizoporella auriculata*, Kirkpatrick, 1890*a*, p. 617.

OCCURRENCE.—St. XIV.

DISTRIBUTION.—Australia, New Zealand.

There is one small colony which must be identified with Macgillivray's species. The colony is young, and is still very transparent and delicately calcified. There is a small raised, triangular avicularium on the frontal wall proximal to the orifice and directed obliquely backwards. The opercula of the ordinary zooecia are roundly triangular; those of the fertile zooecia are more quadrangular (Text-fig. 5, A, B). The ovicell is uniformly punctured. The condyles are denticulate.



TEXT-FIG. 5.—*Schizomavella lata* (Macg.). Operculum of ordinary zooecium (A) and fertile zooecium (B).

The avicularia of the Tertiary form figured by Macgillivray (1895, pl. xi, fig. 5) resemble those of *S. triangula*, described below (pp. 417–418), rather than those of *S. lata*. It is impossible without examining the specimens to tell whether *S. lata*, Thornely (1912 p. 148), is Macgillivray's species or not.

The specimen from Torres Straits, identified by Kirkpatrick (1890*a*, p. 617) with *S. auriculata*, is only represented in the British Museum by a preparation of the chitinous parts (B.M. 32.2.2.2), but the possession of two types of opercula, identical in form with the corresponding opercula of *S. lata*, proves it to have been, as was surmised by Kirkpatrick, a specimen of that species rather than *S. auriculata*. The majority of the mandibles are pointed, but a few are semicircular.

S. lata is closely allied to *S. ambita*, Waters (1889, p. 11). The ovicell of *S. ambita* is larger and flatter and an imperforate crust grows up round it. The orifice of the fertile zooecium is larger, corresponding to the large ovicell. The avicularium is very small in both.

Schizomavella australis (Haswell). (Pl. I, fig. c.)

Hemeschara australis, Haswell, 1881, p. 41, pl. ii, figs. 7, 8.
Schizoporella australis, Harmer, 1902, p. 303, pl. xvii, fig. 47; Livingstone, 1927, p. 61.

Occurrence.—N.E. Low Is.; Low Is., 12 fath.

Distribution.—Queensland, Port Darwin, 8–12 fath. (B.M. 82.2.23.511); Holothuria Bank, N.E. Australia, 9–36 fath. (B.M. 92.1.28.75); Saghalien, Japan (B.M. 62.7.16.3); Singapore (B.M. 86.10.19.1–3).

There can be no doubt of the identity of these specimens with *S. australis*. I have compared them with part of Haswell's material and with Harmer's specimen from Torres Straits, both belonging to the Cambridge Museum.

The colonies (Pl. I, fig. c) have the branched and anastomosing tubular structure figured by Haswell. There is, however, some variation, for the two pieces from the Holothuria Bank are more slender, more irregularly and profusely branched, and show a greater tendency to the formation of irregular superficial layers. In zooecial characters they are indistinguishable from the other specimens. The colony from Port Darwin is complete basally and is attached to a stone by an extensive encrustation, consisting of autozooecia like those forming the erect parts.

There is a good deal of variation in the development of the narrow raised lines outlining the zooecia. In extreme cases they may be conspicuous all round the zooecia or entirely absent. The orifices of the non-fertile zooecia vary very slightly in the depth of the sinus, the opercula varying correspondingly. The orifices of the fertile zooecia are distinctly broader, though the difference is not so pronounced as in some allied species (*e. g. S. ambita* and *S. triangula*). The ovicell is hyperstomial and closed by the operculum. It is flat frontally and sunk in the distal zooecium, and is therefore not very prominent, though, being as wide as the zooecium, it is large. Its sculpture is like that of the frontal wall.

The mandible of the large, proximally directed, frontal avicularia lies, when open, right back against the frontal wall and fits into a groove, which has a rounded end and is fairly uniform in width. These avicularia are only found on some zooecia. Some have no avicularia, and others have a small median one on the proximal side of the orifice directed obliquely towards the distal end of the zooecium. These small avicularia resemble the large ones in having a mandible which lies in a groove when open. *S. triangula* also has a depressed area of the frontal wall proximal to the avicularium, and corresponding in shape to the mandible, which rests in it when open.

In a decalcified and stained preparation the oral glands are rather conspicuous. The polypides are only remarkable for the cæcum, which is sharply defined and very little longer than broad.

S. machaira, Marcus (1922, p. 436), appears to be allied to this species. It differs chiefly in the small number of large irregular pores in the ovicell. The two teeth on the mandible were not seen in *S. australis*. The absence of oral glands in *S. machaira* may only be a seasonal difference.

It seems possible that *S. australis* may, like *S. lata*, and perhaps *S. triangula*, sometimes have been confused with *S. auriculata*. A specimen sent by the Australian Museum as *S. auriculata* proves to be *S. australis*. I have seen no undoubted specimen of *S. auriculata* from Australia. That of Hincks (1880, p. 263) from Glenelg (B.M. 99.5.1.988) is very small and without ovicells, and might equally well be another species of this group.

Emballotheca, sp. (Text-figs. 6, A, 7.)

Occurrence.—St. XII, XXII. Prince of Wales Channel, Torres Straits, 4 fath. (B.M. 82.2.23.82, 525); Murray Island, Torres Straits (B.M. 90.7.23.53); Torres Straits, 10 fath. (B.M. 82.2.23.411); Torres Straits (Cambridge Museum, Coll. Haddon); Port Molle, Queensland (B.M. 81.10.21.5).

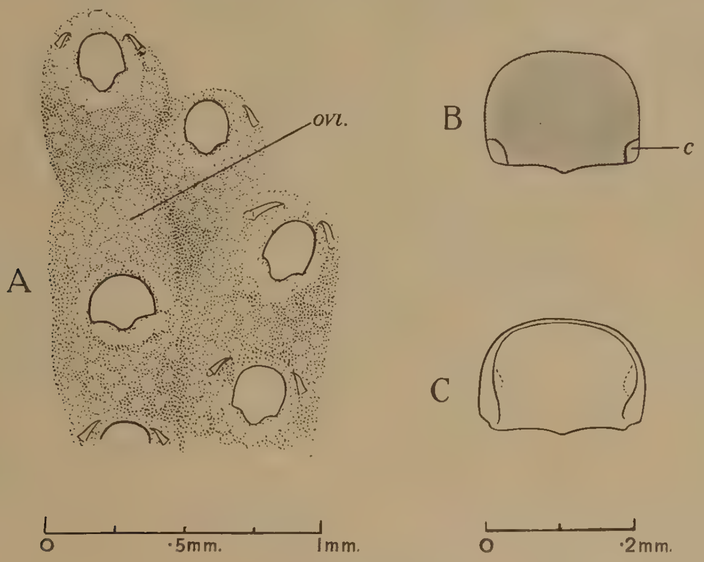
Description.—The zoarium is encrusting or erect and unilaminar or tubular. The zooecia are usually more or less rectangular and arranged regularly, but a superficial layer of irregular zooecia may be formed. The frontal wall and ovicell are uniformly punctured with rather large pores, and there may be some nodular thickening round the orifice (Text-fig. 6, A). The ovicell is large and deeply immersed. The orifice of the non-fertile zooecium is longer than broad; that of the fertile zooecium is broader than long. On many zooecia there is a small avicularium in each distal corner. This avicularium is directed towards the median line on the distal side of the orifice. The beak is somewhat raised and the mandible is narrow and acute. The operculum of the non-fertile zooecium has a thickened border forming a flange on each side to which the occlusor muscles are attached, and sockets at the proximal corners for articulation to the condyles (Text-fig. 7, A). The operculum of the fertile zooecium (Text-fig. 7, B) has a strong sclerite, which is marginal proximally, but round the curved border is a little distant from the edge. Irregularly lobed processes, which appear to be chitinous, project from the distal part of the sclerite.

Remarks.—I have been unable to recognize this species with certainty in any description, but there are several more or less resembling it, so I hesitate to name it as new.

From its occurrence on the Queensland coast and in Torres Straits its presence in Haswell's collection is probable, and there are two species briefly described and not figured by Haswell (1881, p. 39) which somewhat resemble it, namely, *Lepralia*, sp., and *L. assimilis*. The former seems nearer to it, but both are described with a narrow sinus.

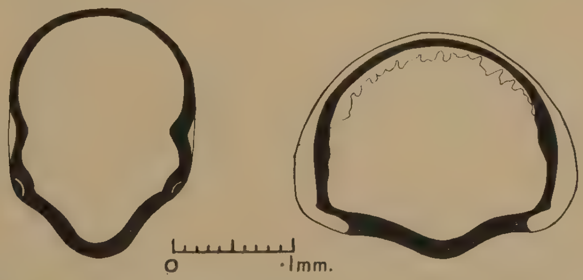
Schizoporella subsinuata, Marcus (1921*b*, p. 16), is similar. The distal avicularia are mentioned by Marcus, though not present on the figured zooecia. The ovicells in Marcus's fig. 8*a* are more prominent, and in fig. 8*c* their pores are shown as still clearly visible after decalcification, and the opercula differ slightly in shape. There can be no doubt that

Marcus had not got *S. subsinuata*, Hincks (1884*b*, p. 280). Hincks figured a specimen with a wide, roughly rectangular orifice with a notch in the proximal border, and his figure is accurate, for some specimens, such as those from Port Phillip (B.M. 88.11.14.414; 97.5.1.767, 827), agree with it exactly. Others have the proximal border, in at least some zooecia, straight or slightly curved, but not notched. All agree in the general shape of the orifice and of the thick condyles in the proximal corners (Text-fig. 6, B). The operculum (Text-fig. 6, C) is very different from that of Marcus's species.



Text-fig. 6.—A, *Emballotheca*, sp. Dry specimen with ectocyst intact. B and C, *Schizoporella subsinuata*, Hcks., from Port Phillip. B, Orifice. C, Operculum. *c.*, Condyle. *ovi.*, Ovicell.

Other species more or less resembling the Barrier Reef species are described by Canu and Bassler (1929, pp. 297–302) under *Emballotheca*. Of these, *E. capitifera* is probably the nearest, but it differs in the shape of the operculum and in the presence of vicarious and absence of adventitious avicularia.



Text-fig. 7.—*Emballotheca*, sp. Operculum of ordinary zooecium (A) and fertile zooecium (B).

The attribution of the present species to *Emballotheca*, Levinsen (1909, p. 333), is in accordance with Levinsen's conception of the genus, both *E. furcata* (see footnote, p. 422) and *E. subimmersa* appearing to be allied species. It is, however, unlikely that any of these three species should be regarded as congeneric with *E. quadrata*, the genotype (Canu and Bassler, 1920, p. 366), which differs in the large curved teeth in the orifice, in the convex proximal border of the orifice and in the operculum.

Stylopoma. (Text-fig. 8.)

The genotype of *Stylopoma* is the W. Indian species figured by Levinsen (1909, pl. xviii, figs. 4 *a–c*), this being clearly the species intended by Canu and Bassler (1920, p. 359), for in repeating their selection (1923, p. 101) they reproduced Levinsen's figures. They showed their specimens from the Gulf of Mexico (1928*b*, p. 92, text-fig. 14 B) with a more uniformly tapering tongue to the operculum and no denticles in the aperture. In the first point at least the specimens of Smitt (1873, p. 42) agreed with Levinsen's, for the sinus was " proximally a little dilated." Specimens from the Tortugas (B.M. 31.11.19.22) and the Galapagos Islands (Hastings, 1930*a*, p. 721) agree with Levinsen's figure and description.

The characters of the genotype of *Stylopoma* are, therefore, sufficiently clearly defined, but the name *E. spongites*, Pallas (1766, p. 45), is not available for it, for Pallas almost certainly confused two species, one from the Mediterranean, to which the name should be restricted (Harmer, 1930, p. 80), and one from America, which is probably the well-known West Indian *Stylopoma.* Canu and Bassler (1923, p. 102) suggested that the name *S. informata* (Lonsdale, 1845, p. 505) could be used for the latter species, and this course has been adopted here.

An ovicellular operculum like that described below (p. 425) is present in all forms of *Stylopoma* examined by me, and may be a generic character.

A tendency to chitinization of the ectocyst round the orifice has been noticed in several of the forms examined, and, as it is almost impossible to separate the operculum completely, it is often difficult to decide which of the visible lines is its true proximal border. The outlines here given have been obtained by careful comparison of decalcified specimens stained with borax-carmine and picric acid, both mounted whole and teased apart, with undecalcified specimens cleared and mounted whole and crushed to separate the opercula. It is possible that the disc-like tip of the tongue (Text-fig. 8, G, K) may not be truly part of the operculum, but it certainly appears to be.

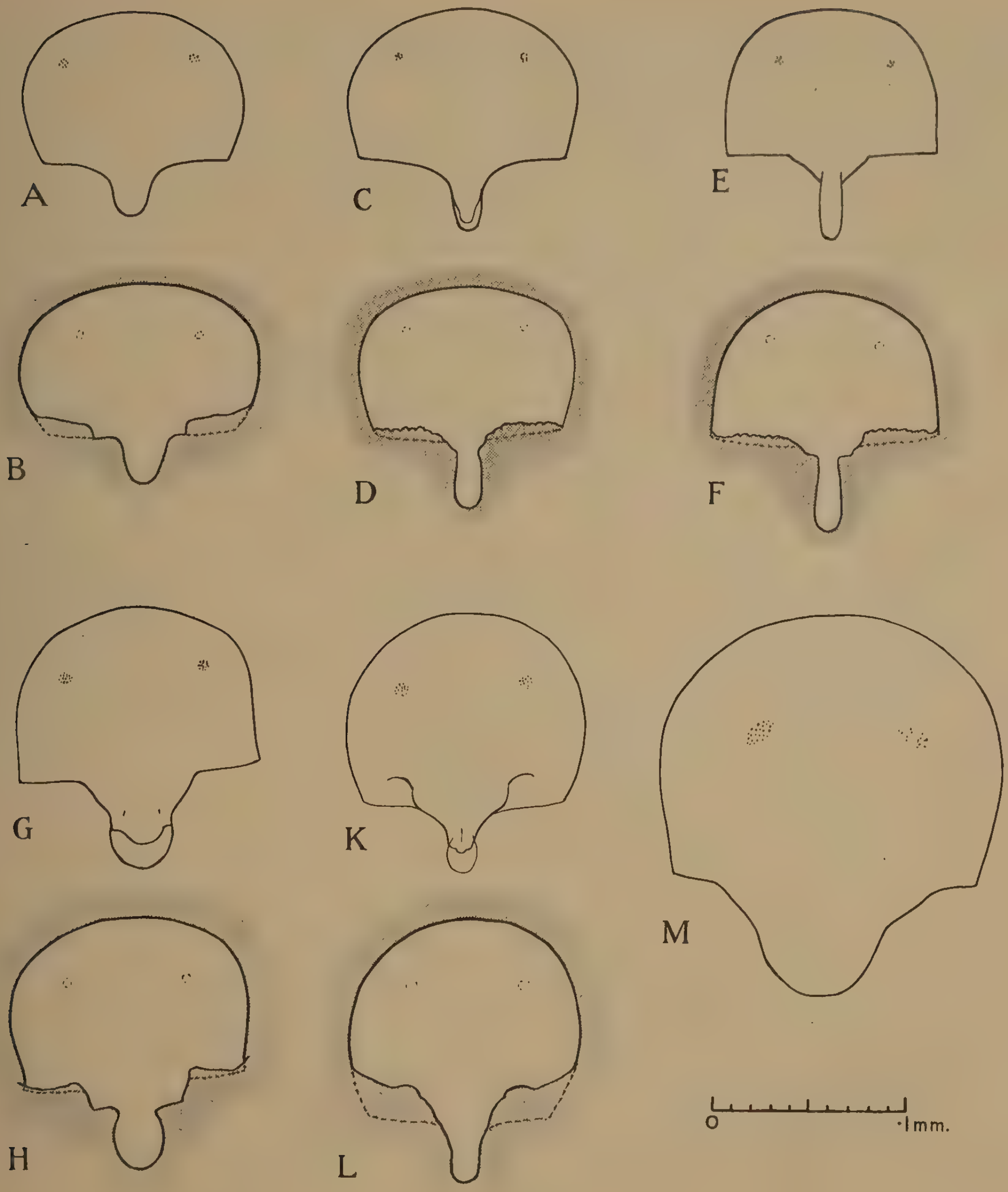
The orifice in *S. informata* (Text-fig. 8, G, H) and *S. schizostoma* (Text-fig. 8, A–F) is more or less semicircular, with a median sinus in the straight proximal margin. The straight edge on each side of the sinus bears a flat plate, which joins the lateral border of the orifice, but may not reach the corner of the sinus (Text-fig. 8, B, H). The edge of the operculum overlaps this plate, which clearly corresponds to the condyle or hinge-tooth in other forms and is here called the condyle.

Stylopoma schizostoma (MacGillivray). (Text-figs. 8, A–F, 9.)

Lepralia schizostoma, MacGillivray, 1868, p. 135.
Schizoporella schizostoma, Macgillivray, 1889, p. 28.
Stylopoma parviporosa, Canu and Bassler, 1929, p. 315, pl. xxxvi, figs. 3–6, text-fig. 131B.

OCCURRENCE.—St. XII, XIII.

DISTRIBUTION.—S. Australia; Victoria; Murray Island, Torres Straits (B.M. 31.9.11.14, 90.3.24.18); West Island, Torres Straits, 17 fath. (B.M. 82.2.23.535); Clairmont Island, N.E. Australia, 11 fath. (B.M. 82.2.23.551); Holothuria Bank, N.W.



TEXT-FIG. 8.—*Stylopoma.* Operculum alone and orifice with operculum in position of: A–F, *S. schizostoma* (Macg.); A, B, from Barrier Reef; C, D, from Fort Phillip; E, F, from Torres Straits. G. H, *S. informata* (Lonsd.), from Galapagos. K, L, *Stylopoma*, sp., from Mascarenes. M, Operculum of *S. viride* (Thorn.). Calcareous parts stippled. Portions of opercula overlying calcareous parts shown by dotted lines.

Australia, 34 fath. (B.M. 92.1.28.43); Amboyna (B.M. 84.2.22.3); New Harbour, Singapore, 7–10 fath. (Cambridge Museum, Coll. Hanitsch); Papeete, Tahiti (B.M. 29.4.25.4); Tizard Bank (B.M. 89.8.21.80); Philippines.

As represented by specimens from Port Phillip in the Bracebridge Wilson Collection (B.M. 97.5.1.763, 764), *S. schizostoma* has a rather narrow sinus and denticulate condyles (Text-fig. 8, C, D). In the specimen from West Island the sinus is longer and narrower (Text-fig. 8, E, F) and the tongue of the operculum is strongly arched, following the contour of the frontal wall, which descends rather steeply to the proximal border of the orifice. As in the Port Phillip specimen, the condyles are toothed. Their surface is ridged and the ectocyst between these ridges is chitinized, so that in preparations of decalcified zooecia the operculum appears to be fringed proximally with long thin teeth. Specimens of *S. parviporosa*, Canu and Bassler, from Romblon and Jolo, Philippines, received from the U.S. National Museum, are more or less intermediate between the two types described above. In the shape of the orifice they agree with those from Port Phillip, but the specimen from Jolo shows some arching of the tongue, and a definite, though less conspicuous, appearance of a fringe. Canu and Bassler's pl. xxxvi, fig. 6, differs from their other figures and from all the specimens described above in the wider, shallower sinus of the orifice. It unfortunately does not show the condyles. The Barrier Reef specimen has the same shape of orifice and smooth condyles (Text-fig. 8, A, B). The specimens from Singapore, Amboyna, Clairmont Island and the Holothuria Bank agree with the Barrier Reef colony in these characters. The one from Tahiti has denticulate condyles and a sinus of variable shape, more or less intermediate, between the Barrier Reef and Port Phillip specimens. It has not been possible to detect any differences other than those in the orifice, and the specimens have all been included in *S. schizostoma*. The ovicells have a pair of teeth in the orifice as figured in *S. informata* (*S. spongites*, Smitt) by Levinsen (1909, pl. xviii, fig. 4*b*), and have an ovicellular operculum like that of *S. informata* described below (p. 425). It is not possible to tell from the figures how nearly *S. spongites* var., Hincks (1887, p. 124, pl. xii, figs. 7, 8), is related to *S. schizostoma*.

The colony from the Holothuria Bank encrusts the frontal surface of a small Cupularian colony, and on reaching the edge has continued to grow freely in the same direction, producing an irregular flatly conical colony the greater part of which is unattached. A similar colonial form has been observed in specimens of three other Schizoporellid species, two from Tsos Sima, Japan (B.M. 62.7.16.69), and one from the Holothuria Bank (B.M. 92.1.28.76). The latter, which is represented by seven specimens, has a hollow, somewhat hooked calcareous process from the basal wall of each zooecium. It resembles *S. furcata*, Busk (1884, p. 163),* in most characters, but differs slightly in the shape of the operculum. It is remarkable for possessing vicarious avicularia with a large mandible, strong muscles and complete polypide; similar avicularia have been described in *Cribrilina philomela* by Harmer (1902, p. 293) and in the Anascan genus *Acanthodesia* (Harmer, 1926, pp. 213 *et seq.*; Hastings, 1930*a*, p. 707).† The avicularia of *Crepis decussata*, Harmer (1926, p. 320) also have a polypide.

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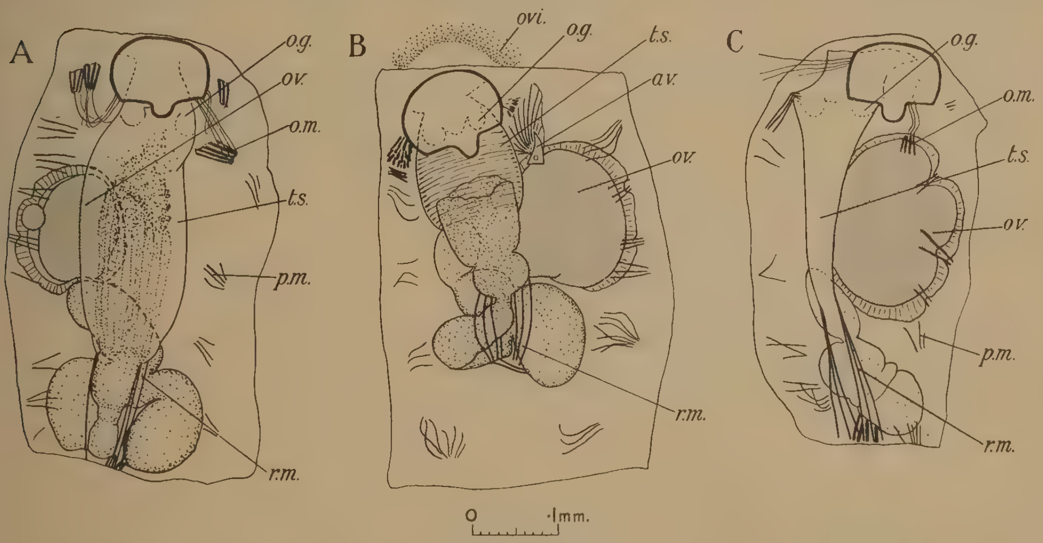
* Examination of the type-material shows that *S. furcata* and *S. tenuis* (Busk, 1884, pp. 163, 165) are synonyms, having been described from the erect and encrusting parts of the same colony. I have retained the name *S. furcata*. The supposed specimen of *S. tenuis* from Simon's Bay appears to be a specimen of *S. nivea*, as pointed out by Waters (1888, p. 29). It is specifically distinct from the material of *S. tenuis* from Honolulu.

† Superficially similar avicularia have been figured in various species, but their internal structure is unknown, *e.g.* *Schizoporella cecilii* var., Kirkpatrick (1890*b*, p. 21, pl. v, fig. 8); *Parmularia quadlingi*, Livingstone (1926*a*, p. 86, pl. vi, figs. 1 and 2); *Schizomavella ovoidea*, Canu and Bassler (1929, p. 305, pl. xxxiii, fig. 7).

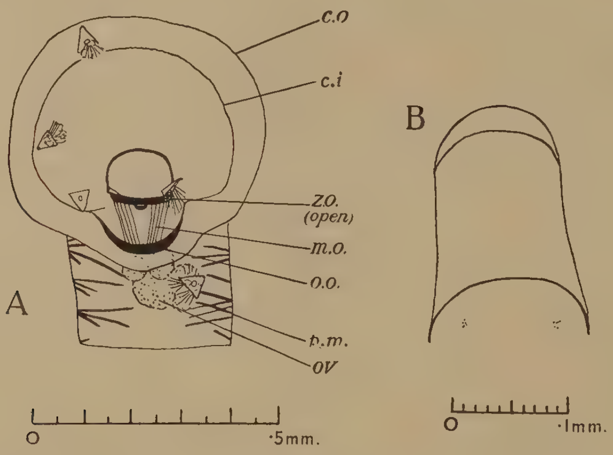
The ovary can be distinguished in zooecia very near the edge of an actively growing colony of *S. schizostoma* killed on 24th February, 1929. In a longitudinal series the walls of one to three marginal zooecia are being formed, the next zooecium contains a polypide bud, the next a fully formed polypide and in the next a small ovary, consisting of one or more small eggs in a follicle, may be present beside the polypide. The "female polypide" of this zooecium has clearly not been preceded by another polypide as described in the W. Indian species by Canu and Bassler (1923, p. 102; 1928*b*, p. 92). Only one of the ova increases in size, but the others remain visible and may form part of the follicle as described by Calvet (1900, p. 294, pl. ix, fig. 2, various Cheilostomes).

These large ovular cells in the follicle project, on the surface, and are rather conspicuous. The ordinary follicle-cells become columnar, considerably increasing the thickness of the follicle. As in Text-fig. 9, A–C, there may be thin places where the follicle is pressed against the parietal muscles. When the egg has attained a considerable size the polypide degenerates, the degeneration beginning at the tips of the tentacles (Text-fig. 9, A). Before degeneration the tentacles usually reach the diaphragm. Text-fig. 9, B, shows a stage where the tentacles are reduced to stumps and the tentacle sheath is shortened and thickened. This short-tentacled degenerating polypide is readily distinguished from a polypide-bud with tentacles of the same length by the irregular and confused appearance of the tentacles, which in the bud are clearly defined and deeply staining, by the completeness of the tentacle-sheath, which in the bud is only beginning to be differentiated, and by the relatively large size of the viscera. At this stage the first indication of the ovicell can be detected. It is a curved band of closely placed cells on the frontal wall of the distal zooecium (Text-fig. 9, B). In Text-fig. 9, C, the tentacles have gone and the viscera are dwindling. The arc of ovicell-forming cells is omitted



TEXT-FIG. 9.—*Stylopoma schizostoma* (Macg.). Three stages in the degeneration of the polypide of a fertile zooecium. In C the operculum has been displaced in mounting. *av.*, Avicularium. *o.g.*, Oral gland. *o.m.*, Occlusor muscle. *ov.*, Ovary. *ovi.*, Incipient ovicell. *p.m.*, Parietal muscle. *r.m.*, Retractor muscle. *t.s.*, tentacle sheath.

from this figure. It has become more arched—that is, its median part has advanced distally. There is an indication of the outer capsule outside this cellular band, and both capsules are beginning to grow down beside the orifice. The frontal wall of the ovicell is incomplete. This is the most advanced stage obtained in *S. schizostoma*. It would be interesting to see later stages. The large amount of space occupied by the egg makes the formation of another polypide before the completion of the ovicell very improbable. In the American species Canu and Bassler write of a female polypide without tentacles " which constructs the ovicell." They do not explain in what way such a polypide is supposed to assist in the construction of the ovicell. In *S. schizostoma* the polypide without tentacles is clearly degenerating, and the occurrence of this degeneration when the ovicell is beginning to be formed shows, I think, that in that species the polypide takes no active part in building the ovicell. Doubtless the degeneration of the polypide liberates materials for use in other ways, but there is the increase in size of the egg as well as the construction of the ovicell to account for. Little or no trace of oral glands has been detected in the non-fertile zooecia. In the early stages of the fertile zooecia a small protuberance on each side of the diaphragm can usually be detected, and in later stages, such as are figured here, a pair of spherical glands is clearly present.



Text-fig. 10.—*Stylopoma informata* (Lonsd.) from Galapagos. A, Fertile zooecium and empty ovicell decalcified. B, Ovicellular operculum and tip of zooecial operculum; muscles omitted. *c.i.*, Inner capsule. *c.o.*, Outer capsule. *m.o.*, Muscles of ovicellular operculum. *o.o.*, Ovicellular operculum. *ov.*, Ovary. *p.m.*, Parietal muscle. *z.o.*, Zooecial operculum.

A few zooecia contain clusters of sperm-forming cells, but spermatozoa are not being developed in any quantity. In a colony of *S. informata* (*S. spongites*, Hastings, 1930*a*, p. 721) collected at the Galapagos Islands on 7th August, 1924, the marginal zooecia contain large quantities of mature sperm, and a small ovary may be present as well. Within this marginal zone many of the zooecia bear fully-formed ovicells, but earlier stages of the fertile zooecia have not been found. The ovicell-bearing zooecia, which all have enlarged parietal muscles and no polypide, are in three states: (1) The ovicell is empty, and a large egg, enclosed in a follicle and accompanied by some small ones, occupies the cavity of the zooecium. (2) There is a large egg or embryo in the ovicell, and in the body-cavity an ovary consisting of a cluster of eggs, most of which are rather larger than the accessory eggs in state 1. (3) The ovicell is empty and the ovary may be in state 2, or one of the eggs may be enlarged and surrounded by a definite follicle. After decalcification the fully formed ovicell of the Galapagos specimen is seen to consist of a pair of concentric, spherical, membranous capsules (Text-fig. 10, A). The zooecial orifice opens into the ovicell, and to the distal end of its operculum is attached an ovicellular operculum (Text-fig. 10, A, B). This ovicellular operculum is less strongly chitinized than the zooecial operculum; it appears to be continuous laterally with the inner membranous sac, and it is deeply hollowed. A pair of broad muscle-bands run from its distal border and appear to be attached within the zooecial orifice, but the exact point of attachment cannot be made out. Numerous fine muscles radiate from the distal border of the zooecial orifice to the walls of the inner membranous sac. They are so numerous and so fine that they have been omitted from the figure. It will be noticed that the avicularium buried beneath the ovicell has lost its musculature. Those with muscles are on the surface of the ovicell.

A specimen from the Providence Reef, Mascarene Islands (B.M. 82.10.18.48) appears to be the form obtained from the Gulf of Manaar by Waters (1918*a*, p. 17). The orifice (Text-fig. 8, L) has a knob-like tooth on each side of the sinus, and the sockets in the operculum to which these teeth articulate are conspicuous. The operculum (Text-fig. 8, K) resembles that of the genotype in having a disc-like tip to the tongue, but both tongue and tip are narrower and the operculum is uniformly curved in outline, not wider proximally. The orifice of the ovicell is traversed by a calcareous bar, occupying the position of the teeth in most other species. The ovicell thus has two orifices and resembles that of *S. viride*, in which, however, the bar is broader, and the ovicell being flatter the orifices are directed proximally instead of obliquely towards the frontal wall of the fertile zooecium. As suggested by Canu and Bassler (1928*b*, p. 92) this appears to be a distinct species.

Stylopoma viride (Thornely). (Text-fig. 8, M.)

Schizoporella viridis, Thornely, 1905, p. 116, pl. i, fig. 3; 1912, p. 148; Waters, 1909, p. 147, pl. xiii, figs. 1–8; 1918*a*, pl. ii, fig. 18; Marcus, 1921*b*, p. 17; Livingstone, 1926*a*, pl. viii, fig. 10.
Stylopoma grandis, Canu and Bassler, 1929, p. 316, pl. xxxvii, figs. 1–3.

OCCURRENCE.—Batt Reef; Low Is. (shore).

DISTRIBUTION.—New Guinea, Aru Islands, Philippine Islands, Indian Ocean, Red Sea.

There can be no doubt that these specimens belong to Thornely's species, with which they agree very exactly. The pieces of Thornely's specimen in the British Museum (06.12.3.10) and the Manchester Museum (Waters Collection) are both without ovicells, but one is shown by Thornely (1905, pl. i, fig. 3) and agrees with those of the Barrier Reef specimen. The separation of the transverse oval orifice of the ovicell from the zooecial orifice, as shown in this figure, is mentioned by Waters and Marcus. This is all that can be seen in direct frontal view, but, by tilting the Barrier Reef specimens, a slit can be seen between the proximal edge of the ovicell and the frontal wall of the zooecium. The sinus of the zooecial orifice can be seen through this aperture. The zooecial operculum bears an ovicellular operculum as in the other species of *Stylopoma* described above. On many of the ovicells of the Barrier Reef specimens of *S. viride* there is a small pointed avicularium, directed outwards on each side of the oval distal aperture, and there may be small ones on humps on the distal circumference of the ovicell.

The elongated, adventitious avicularium on the distal side of the orifice (Thornely, 1905, pl. i, fig. 3; 1912, p. 148) may be present on nearly every zooecium of the single regular layer at the edge of the colony. It may be transverse as shown, or placed beside the orifice, pointing obliquely towards the distal end of the zooecium. Its mandible, like that of the vicarious avicularium, has a triangular base and a long, laterally compressed, knife-like rhachis. The small avicularium below the orifice may be present on the same zooecium as the large distal one.

The Mediterranean specimen which Waters (1909, p. 147) identified with *S. viride* is superficially very similar, but it has markedly different opercula and mandibles and is clearly a distinct species. Busk's manuscript name for it, published by Waters, remains a *nomen nudum*.

S. grande, Canu and Bassler (1929), is clearly a synonym of *S. viride* (Thornely). It agrees in the shape of the orifice, in the form of the adventitious and vicarious avicularia, in the ovicells, in the plurilamellar colony and the green colour.

Livingstone (1926*a*, p. 84) described a variety of *S. viride* with blunt vicarious avicularia which was obtained on the Barrier Reef. This variety is not represented in the present collection. While fully recognizing their distinctness, Livingstone compared some characters of this variety to *Schizoporella ampla*, Kirkpatrick (1888*a*, p. 76). It may be worth recording that I have examined the type of *S. ampla*, and confirmed the accuracy of Kirkpatrick's description and figures. The comparatively small ovicell, which does not cover the orifice, will, if *Stylopoma* is found to be a good genus, distinguish *S. ampla* and *S. viride* generically.

Hippothoa distans, Macgillivray.

Hippothoa distans, MacGillivray, 1869, p. 130; Waters, 1904, p. 54, pl. iii, figs. 8*a–g* (references).
Hippothoa flagellum, Canu and Bassler, 1929, p. 247, p. xxii, fig. 7.

Occurrence.—St. XII.

Distribution.—Australia, New Zealand, Malaya, Indian Ocean, European Seas, Atlantic, Antarctic, Queen Charlotte Island.

This specimen, like that of Canu and Bassler, has the ovicell-bearing cells of approximately the same size as the rest. A specimen from Port Phillip (B.M. 97.5.1.788) agrees with Waters's figure in having small ovicelligerous cells.

Mastigophora pesanseris (Smitt).

Hippothoa pes anseris, Smitt, 1873, p. 43, pl. vii, figs. 159, 160.
Mastigophora pesanseris, Osburn, 1927, p. 130; Canu and Bassler, 1929, p. 412, pl. lviii, figs. 4–8 (references).
Mastigophora pes-anseris, Hastings, 1930*a*, p. 722.

Occurrence.—N.E. Low Is.

Distribution.—Philippines, Hawai, Indian Ocean, Madeira, Brazil, Florida, Panama.

Trypostega venusta (Norman).

Lepralia venusta, Norman, 1864, p. 84, pl. x, figs. 2, 3.
Trypostega venusta, Livingstone, 1927, p. 58; Canu and Bassler, 1929, p. 248, pl. xxii, figs. 9–11; Hastings, 1930*a*, p. 720 (references).

Occurrence.—St. XIII.

Distribution.—Queensland; Philippines; China Sea; Jicaron Island, Panama; Indian Ocean; Atlantic; English Channel.

Microporella ciliata (Pallas).

Eschara ciliata, Pallas, 1766, p. 38.
Microporella ciliata, Maplestone, 1909, p. 268; Osburn, 1927, p. 129; Canu and Bassler, 1929, p. 331, pl. xl, figs. 2–4; Hastings, 1930*a*, p. 727 (references).

Occurrence.—St. XIII, XXI.

Distribution.—Cosmopolitan.

The specimen from St. XIII is a small colony of the typical form, and has very thin walls and somewhat elongate avicularia. That from St. XXI is of the personate type.

Microporella malusii (Aud.).

Cellepora malusii, Audouin, 1826, p. 239; Savigny, pl. viii, figs. 8^1, 8^2.
Microporella malusii, Waters, 1887, p. 188; Kirkpatrick, 1890*a*, p. 612; Macgillivray, 1890*c*, p. 4; Marcus, 1921*c*, p. 108, pl. v, fig. 8; 1921*d*, p. 107, text-fig. 9; Livingstone, 1926*a*, p. 98; 1927, p. 62.
Fenestrulina malusii, Canu and Bassler, 1923, p. 115, pl. xxxvi, figs. 2, 3 (literature); Livingstone, 1929, p. 89.

Occurrence.—St. XII.

Distribution.—Cosmopolitan.

Another Australian form allied to *M. malusii* is represented in the British Museum (97.5.1.677 and 679) by specimens from Port Phillip and in the Cambridge Museum by some from Port Jackson. The ovicells are deeply immersed in the distal zooecium, so that they hardly project frontally, although all the parts of the ovicell of typical *M. malusii* can be recognized in them.

Microporella mutabilis, sp. n. (Plate I, fig. D; Text-fig. 11.)

Microporella malusii, Haswell, 1881, p. 38; Livingstone, 1926*a*, p. 98.
? *Microporella malusii*, Thornely, 1912, p. 146, pl. viii, fig. 8.

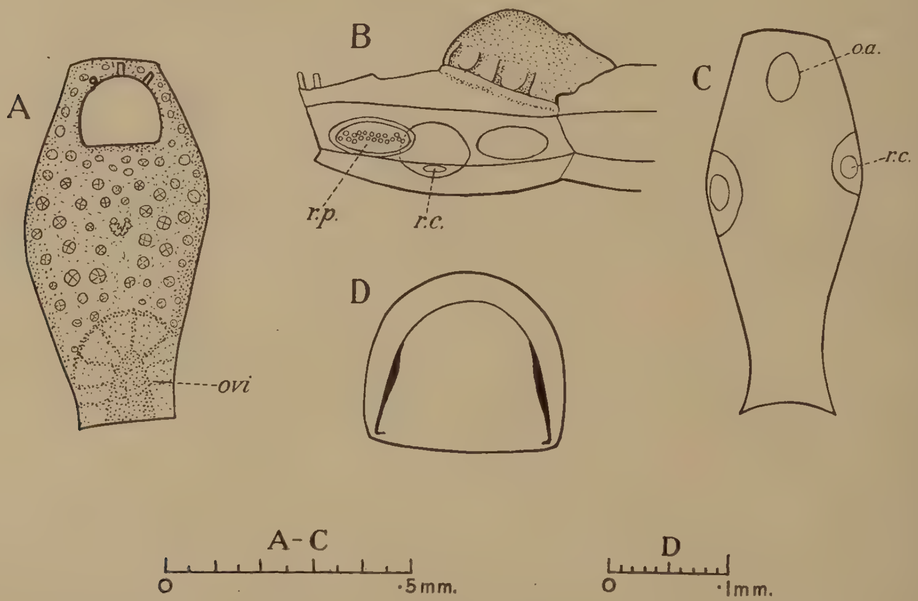
Occurrence.—St. XII.

Distribution.—Great Barrier Reef, Port Denison.

Type.—St. XII (B.M. 32.4.20.50).

Description.—In *M. malusii* the colony is encrusting, the zooecia are not much longer than wide, and the frontal wall has an imperforate area behind the ascopore, the stellate, frontal pores being more or less marginal. There are three long, narrow pore-chambers, one distal and one on the distal half of each lateral wall. In the type-specimen of *M. mutabilis* the colony is hemescharan (Plate I, fig. D), and has a flustrine appearance (*cf.* Livingstone, 1926). Its basal surface is covered throughout by a thin layer of a sponge, *Oscarella tenuis*, Hentschel, but the hemescharan form is not due to this, for a hemescharan specimen from Port Denison is quite free from sponge, and Mr. Livingstone informs me that none of his specimens bear any such growth. The stellate pores are uniformly distributed over the frontal surface, and the zooecia are usually considerably longer than broad (Text-fig. 11, A). The orifice is approximately the same size as in *M. malusii*, but may be a little longer in proportion to its width. The operculum (Text-fig. 11, D) is essentially similar, but the sclerite is a little further from the margin. There may be two to four spines on the distal border of the orifice. The sponge can be readily peeled off, and the basal surface is then found to differ from that of *M. malusii*. In the majority of the zooecia no pore-chambers are visible, and it seems that they really are absent, their places being taken by three multiporous rosette-plates, each occupying the elongate, oval area of the lateral or distal wall against which the pore-chamber is found in *M. malusii.* The basal wall (Text-fig. 11, C) has an oval, uncalcified area of variable size in its distal part, and on each side a chamber from which a rootlet may spring. The rootlet chamber resembles a pore-chamber in occupying the angle between the basal and lateral walls, and being cut off from the body-cavity by an oblique wall. This wall bears a group of pores. The chamber is placed proximally to the rosette-plate and very close to it (Text-fig. 11, B). The rootlet-chambers and oval area are not found on all the zooecia, and one, two or three pore-chambers may be present.

On the cruise of H.M.S. " Alert " escharan as well as hemescharan specimens of this species were obtained from 3–4 fath. off Port Denison (B.M. 81.10.21.23, 82.2.23.89). No exact locality is given for a loosely encrusting colony obtained on the same cruise (B.M. 81.10.21.355). These specimens agree with the Barrier Reef specimen in their large zooecia, and large, evenly distributed pores. The distribution of pore-chambers, rootlet-chambers and oval areas is most erratic. In the hemescharan specimen the majority of the zooecia have the oval area present and pore-chambers absent, but the oval area may be absent and one or more pore-chambers may be present. Rootlet chambers were not found. The two layers of the escharan specimen are readily separable, and between them is a thin layer of material which contains some spicules and may be a sponge. Neither oval areas nor rootlet chambers were seen and pore-chambers are very irregularly distributed, many zooecia having none, others one, two or three. The loosely encrusting specimen agrees with the type in having an oval area, rootlet-chambers and no pore-chambers in the majority of its zooecia and it shows similar variability. There may be two rootlet-chambers on the same side of the zooecium, one occupying the distal corner.



TEXT-FIG. 11.—*Microporella mutabilis,* sp. n. A, Frontal view. B, Side view. C, Basal view. D, Operculum. *ovi.*, Incipient ovicell of proximal zooecium. *o.a.*, Oval area. *r.c.*, Rootlet-chamber. *r.p.*, Rosette-plate.

Occasionally, notably in the material from Port Denison in the Cambridge Museum, there is a pair of small lateral oval areas in the basal wall, marking the attachment of the occlusor muscles of the operculum.

To sum up, this species is distinguished from *M. malusii* by the larger size of its zooecia, by the uniform distribution of the pores, by the absence of pore-chambers in some zooecia and by slight differences in the orifice and operculum. The colony may be escharan, hemescharan or loosely encrusting. The oval area and rootlet-chambers are not invariably developed, but they are very distinctive when present. *M. malusii* and *M. mutabilis* were both obtained at the same station in 10–15½ fath.

Remarks.—Part of the material from Port Denison identified by Haswell (1881, p. 38) with *M. malusii* is in the Cambridge Museum and belongs to *M. mutabilis*. *M. malusii*, Thornely (1912), from the Indian Ocean, agrees with *M. mutabilis* in its large zooecia and uniformly distributed pores, but no ribs are described or figured round the ovicell.

A loosely encrusting specimen, collected by Darwin at the E. Falkland Islands (B.M. 99.7.1.2668), seems to be nearer to *M. mutabilis* than to *M. malusii*, though distinct from both. It agrees with *M. mutabilis* in its large zooecia and pores, in the presence of an oval area in the basal wall and in the absence of pore-chambers. There are no rootlet chambers. It has a small area free from pores behind the ascopore, thus approaching *M. malusii*. The ends of the sclerite of the operculum turn slightly outwards, and show no trace of the little sclerite projecting at right angles that is found in *M. malusii* and *M. mutabilis*. The orifice is considerably larger than in *M. malusii*, and the ovicell may bear fine radiating striations. Similar specimens were obtained by the "Challenger" from the Falkland Islands, and by Jullien (1888, p. 38) and Darwin at Tierra del Fuego. The latter material is figured by Busk (1854, pl. ciii, figs. 1–3), who mentions the large size of the zooecia compared with the European form. The "central flattened disc" is evidently the oval area. It is of similar size in the Falkland Island specimen. It appears rather different from that of *M. mutabilis* owing to its large size, but there is considerable variation in this respect in the hemescharan specimen from Port Denison, some being as large as those from the Falkland Islands. The ancestrula is included in two of Darwin's specimens, and the surrounding zooecia are of the thyreophora-form. The ancestrula is membraniporine and has spines all round the opesia. Waters (1904, p. 42) records specimens of the thyreophora-form from Chili, with large zooecia and apertures, which may be the same species.

Canu and Bassler (1928*a*, p. 84) described *Fenestrulina ampla*, a large species from Brazil, which differs from Darwin's species in its small circular ascopore, thick border to the operculum and rather smaller orifice. The average of a number of measurements of the orifices of Darwin's species exceeds the maximum given by Canu and Bassler for *F. ampla*.

Smittina signata (Waters). (Text-fig. 12 D, E.)

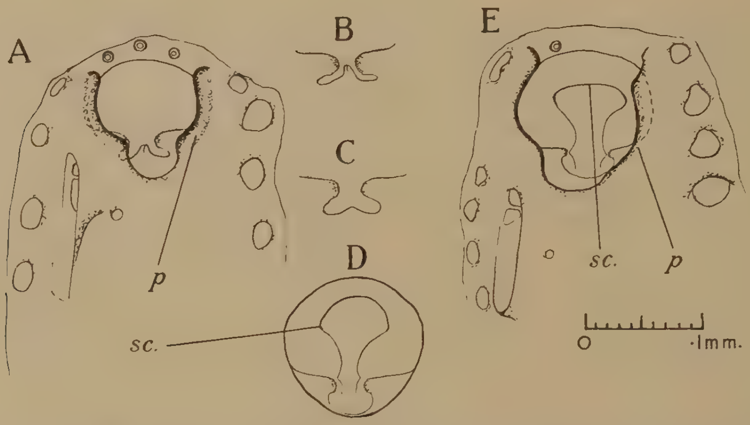
Smittia signata, Waters, 1889, p. 17, pl. iii, figs. 4–6; Thornely, 1912, p. 151.
Lacerna signata, Canu and Bassler, 1929, p. 308, pl. xlii, figs. 10, 11, text-fig. 131C (not D).

Occurrence.—N.E. Low Is.; St. XXII.

Distribution.—New South Wales, Indian Ocean, Philippines, Tahiti (Crossland Coll., B.M. 29.4.25.2 and 3).

These small encrusting colonies agree very closely with Waters's type-specimen. The sclerites of the operculum (Text-fig. 12, D, E) are more bowed, but, as the figures show, there is some variation in their shape. The peristome may be less developed, or may be continued round the distal border of the orifice. The ligulate avicularia vary in size, and may be only half the length of that figured. The large, spatulate avicularia are more numerous towards the centre of the colony. The spines are rarely visible, their stumps apparently becoming buried in a calcareous crust.

The specimens of Canu and Bassler (1929) from the Philippines appear to differ in the triangular shape of the sclerite of the operculum, but under a low magnification the more constricted sclerites of the Barrier Reef material may give this impression. The Barrier Reef specimens agree in size with those from the Philippines, the orifices being slightly larger than in the type. In some fragments from Okinose, off Tokyo, in the Cambridge Museum, the zooecia and orifices are even larger (diameter of orifice ·13–·15 mm.). In this Japanese material the denticulation extends along the distal border of the condyle, as in *Smittina* sp. (Text-fig. 12, A–C) from the Tizard Bank, described below.



TEXT-FIG. 12.—A–C, *Smittina*, sp., from the Tizard Bank. D, E, *Smittana signata* (Waters). A, Distal part of a zooecium. B, C, Lyrula and condyles. D, Orifice and operculum. E, Distal part of a zooecium. *p.*, Peristome. *sc.*, Sclerite.

Canu and Bassler put *S. signata* in *Lacerna*, Jullien (1888, p. 48), but according to Waters (1904, p. 51) the genotype, *L. hosteensis*, has a schizoporellid operculum. *S. signata* differs from the typical species of *Smittina* chiefly in the absence of a median tooth or lyrula, and at present I see no need to separate it, more especially as a very similar species from the Tizard Bank (B.M. 89.8.21.17b) has a pointed tooth of variable size in the position of the lyrula (Text-fig. 12, A–C). The specimen is unfortunately very small and without opercula. The peristome, the denticulate condyles and the spatulate and ligulate avicularia are very much like those of *S. signata*, but the denticulation extends along the distal border of the condyle as in the Japanese specimen described above.

Schizopodrella horsti, Osburn (1927, p. 127), appears to be another *Smittina*-like species with no lyrula. The operculum is described as slightly chitinized and is presumably without the sclerites of *S. signata*.

The species from the Red Sea, identified by Waters (1909, p. 157, pl. xiii, fig. 9) with *S. marmorea*, appears to be more nearly related to *S. signata*, but its operculum is unknown.

Smittina obstructa (Waters).

Smittia obstructa, Waters, 1889, p. 18, pl. iii, figs. 7, 8.

Occurrence.—Batt Reef.

Distribution.—New South Wales.

This specimen agrees closely with Waters's, but has no ovicells. The operculum is of characteristic form, but slightly less chitinized. The peristome is prominent laterally, though not quite so markedly so as in Waters's specimen, and frequently has an avicularium "leaning against the prominence." There are small blunt avicularia on the frontal wall of some zooecia and some very large spatulate ones. In this specimen, unlike that described by Waters, the large spatulate avicularia are not vicarious, but are on the frontal wall, with their proximal end beside the orifice of the zooecium. The only one visible on the specimen from the Waters Collection lent to me is, however, similar, though the orifice of the zooecium can only be discerned clearly when the specimen is wet. In form and position the spatulate avicularia resemble those of *S. trispinosa* var. *inaequalis* (Waters, 1879, p. 41), and superficially the specimen might be taken for that form, especially as a Neapolitan specimen of the latter presented by Mr. Waters (B.M. 79.4.25.25) has a pointed avicularium beside the peristome of some zooecia. The two forms are clearly distinguished by their opercula.

Smittina acaroensis, Levinsen.

Smittina acaroensis, Levinsen, 1909, p. 342, pl. xviii, figs. 12*a*, *b* (*S. akaroensis* in description of plate).

Occurrence.—St. IX, XII.

Distribution.—New Zealand, Bass Strait (B.M. 99.5.1.1127).

These two young colonies do not show the extreme development of the ribs between the areolae described by Levinsen. The spines vary from 4 to 6, and the areolae do not form such a definite border to the ovicell. Otherwise the agreement with Levinsen's description is very close. The material is insufficient for examination of the rosette-plates. The mandible is semicircular, with two oblique sclerites. Older colonies from New Zealand in the British Museum show advanced calcification as described by Levinsen. In the specimen from Bass Strait the avicularia vary in size.

S. acaroensis is very closely allied to the areolated type of *S. landsborovii* shown by Hincks (1880, pl. xlviii, fig. 7). The specimens of *S. acaroensis* in the Hincks and Wilson Collections in the British Museum are labelled "*S. landsborovii* ?" and it seems possible that some of the published records of *S. landsborovii* in the Australian and Indo-Pacific regions may be based on this species.

Phylactella geometrica, Kirkpatrick.

Phylactella geometrica, Kirkpatrick, 1890*b*, p. 20, pl. v, figs. 7–7*c*.

Occurrence.—St. II.

Distribution.—China Sea.

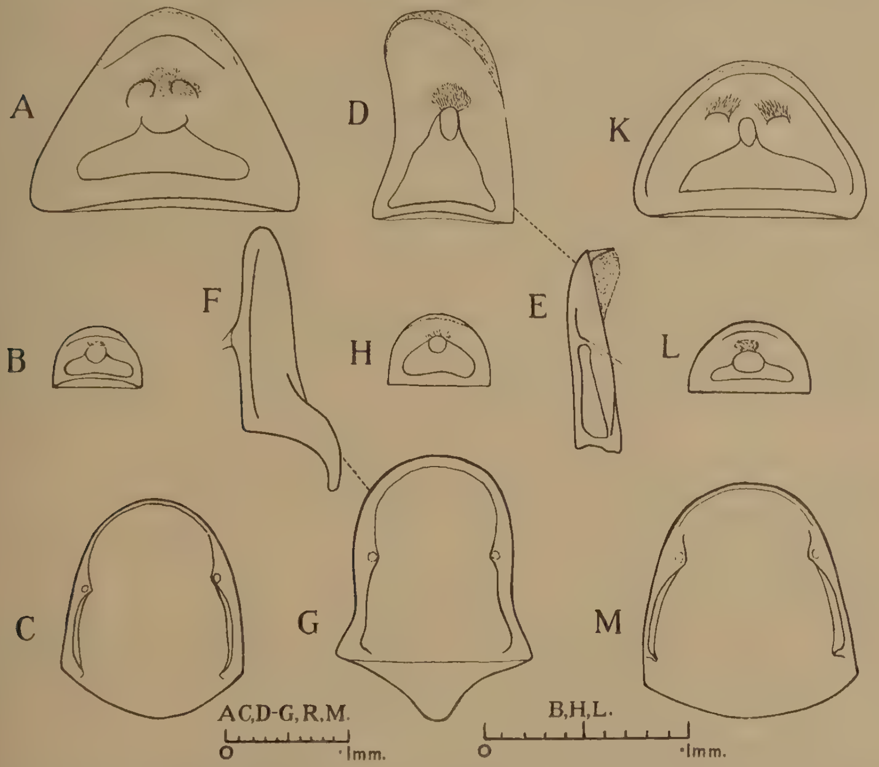
Cigclisula. (Text-fig. 13.)

Escharoides occlusa, Busk (1884, p. 150) has been referred to the following other genera: *Lepralia* (by Waters, 1888, p. 26), *Myriozoum* (by Levinsen, 1909, p. 301, and Marcus, 1921*a*, p. 20; 1922, p. 435), *Cigclisula* (by Canu and Bassler, 1927*a*, p. 6). Livingstone (1926*a*, p. 91) puts the closely allied form *C. areolata* (Kirkpatrick, 1890*a*, p. 618) in *Porella*. Although retained provisionally by Marcus, I think the attribution to *Myriozoum* can be dismissed at once for the reasons given by Waters (1913, p. 519). *Escharoides*, Milne-Edwards (1836, p. 259), is almost unanimously abandoned owing to difficulties about the genotype which need not be recounted here. Strictly according to the rules *Lepralia* is a synonym of *Escharoides*, but Norman (1903, p. 99) and Lang (1917, p. 171) retain it with *Lepralia nitida* (Fleming) as genotype. In either case the name is not available for *E. occlusa*, which differs in its orifice from *L. nitida*, and from all the other species included in *Lepralia* by Johnston. *Porella* was introduced by Gray (1848, p. 127) for *Millepora cervicornis*, Solander (1786, p. 134), *M. compressa*, Sowerby (1805, p. 83), being given as a synonym. These two species are distinct, and Norman (1903, p. 112) selected *M. compressa* as the genotype of *Porella*. This selection has priority over that of *M. cervicornis* by Canu and Bassler (1917, p. 54). *Cigclisula* was introduced by Canu and Bassler (1927*a*, p. 6) with *E. occlusa* as genotype.

The choice of genus for *E. occlusa* thus lies between *Porella* and *Cigclisula*, but before their claims can be considered the characters of *E. occlusa* must be defined a little more closely.

Marcus (1921*a*, pl. i, fig. 8) figured an operculum shaped to fit an orifice with a definite sinus. He assumed some inaccuracy in Waters's figure (1888, pl. iii, fig. 32) of an operculum from the type-specimen from Samboangan. Waters's is an accurate picture of some opercula. Others on the same slide are longer, like those of Canu and Bassler (1929, p. 292, text-fig. 122, C, D), but none approach the type of operculum figured by Marcus. Such an operculum is, however, found in three specimens in the British Museum (B.M. 92.1.28.71A and 72, 86.2.19.9), all from W. or N.W. Australia, which is the region from which Marcus obtained his first material (Text-figs. 13, F, G). His specimens from the Aru Is. (1922, p. 435) were apparently of the same type. The two forms agree closely except for the remarkable difference in the orifice, and more or less intermediate specimens are found (B.M. 92.4.14.4, 51.11.14.75).

The type of *E. occlusa* resembles *P. compressa* and the species associated with it in many ways. They agree in the more or less semicircular primary orifice, with rounded corners, the thickening of the frontal wall and the formation of a peristome with an avicularium in its proximal wall. The formation of the ovicell seems to be similar, though the incomplete frontal calcification of that of *E. occlusa* gives it a superficially different appearance. There are some differences, however, that may be more important. Oblique sclerites are not a conspicuous feature of the mandibles of *E. occlusa*, and the oral glands form a large and rather complex median structure (Waters, 1909, p. 152). *P. compressa* has paired glands of ordinary size and shape. In *P. compressa* the formation of the peristome and avicularium is accompanied by a thickening and straightening of the proximal lip of the primary orifice, almost amounting to the formation of a broad shallow lyrula, though a lyrula is usually stated to be absent in *Porella*. In *E. occlusa* the proximal edge is more concave and remains so. In *P. compressa* and most if not all undoubted species of *Porella* the peristomial avicularium is median and directed frontally; in *E. occlusa* it is lateral and directed obliquely. If *E. occlusa* were the only species of its kind the differences enumerated above would hardly justify its separation from *Porella*, but the existence of several species allied to *E. occlusa*, and differing from true *Porella* in most if not all these ways (the oral glands of some are not known), supports the view that *E. occlusa* deserves generic rank. Besides the two species recorded in this paper, *Porella fissurata*, Ortmann (see Livingstone, 1926*a*, p. 92), and *Cellepora verticalis*, Maplestone (1910, p. 39), appear to be congeneric with *E. occlusa*. A topotype of *C. verticalis* (B.M. 10.9.19.1) agrees with *E. occlusa* in the general form of the primary orifice and operculum (Text-fig. 13, M), in the very extensive secondary calcification, in the position of the avicularium in the peristome, in the structure of the avicularian mandibles (Text-fig. 13, K, L), and in the ovicell with a frontal fissure. It differs in the wider, less shaft-like peristome, in which the avicularium remains clearly visible, in the form of the colony and in the absence of vicarious avicularia. I have accepted *Cigclisula* for this group of species, and would distinguish it from *Porella* by the fissured ovicell, lateral and oblique peristomial avicularium, and possibly the large median gland. The definition



TEXT-FIG. 13.—A–C, *Cigclisula cautium*, sp. n. D–H, *C. occlusa* from the Holothuria Bank, "Marcus's form." K–M, *C. verticalis* (Maplest.). A, Mandible of large oral avicularium of marginal zooecium. B, Mandible of small oral avicularium. C, Operculum. D, E, Mandible of large oral avicularium, slightly oblique and lateral views. F, G, Operculum, frontal and lateral views. H, Mandible of small oral avicularium. K, L, Mandible of large and small oral avicularia. M, Operculum.

of Canu and Bassler must be modified to admit forms with a simply fissured ovicell and a frontal wall with either pores or areolae. *Porina serrulata*, Smitt (1873, p. 27), was included in this genus by Canu and Bassler (1928*b*, p. 125), but is omitted here because of its median pore. It also differs in the position of the peristomial avicularium.

In *C. verticalis* the basal parts of the escharan colony become thickened by the development of superficial layers of zooecia. It is interesting to compare the method in *C. occlusa*, where superficial layers are not formed to any marked extent, but the old zooecia at the base of the colony are converted into kenozooecia. This takes place by great thickening of their calcareous walls and closure of the orifice as described by Busk (1884, p. 150). In some specimens, *e. g.* that from Albany Passage, Torres Straits (B.M. 90.3.24.51), this formation of kenozooecia may take place in stages. First there is a great deposition of calcareous matter and the orifice becomes smaller. Then an avicularium is formed over the orifice with its mandible directed backwards. The mandible resembles those of the vicarious avicularia in shape, but is smaller. It is also distinguished by its direction, those formed at the growing edge in the ordinary way pointing forward (Canu and Bassler, 1929, p. 291). As calcification proceeds a film of calcareous matter spreads over the avicularium and it finally becomes buried. Thus the ultimate appearance of the kenozooecia is the same whether an intermediate avicularian stage occurs or not. This forms an interesting parallel to the processes of secondary thickening in the Reteporidae described by Buchner (1924, p. 173, etc.), in which the avicularia play an important part.

Cigclisula areolata (Kirkpatrick).

Lepralia occlusa, var. *areolata*, Kirkpatrick, 1890, p. 618, pl. xvi, figs. 7, 7*a*.
Porella areolata (encrusting specimens), Livingstone, 1926*a*, p. 91, pl. viii, fig. 4; 1927, p. 64.
Not *Porella areolata*, Ortmann, 1889, p. 42.

OCCURRENCE.—Batt Reef.

DISTRIBUTION.—Torres Straits, Barrier Reef.

There is a circular encrusting colony of this form, with a second layer of zooecia forming at the centre. The type-specimens are encrusting and several layers thick. Livingstone records both encrusting and erect forms from the Barrier Reef, but there is evidence, as explained below under *C. cautium*, that his erect specimens belonged to that species. Spatulate avicularia are present as they are in the type, though not mentioned by Kirkpatrick, and in Livingstone's specimens. Spirit material for the examination of the oral glands has not been available.

The primary orifice of *C. areolata* is broader in proportion to its height and rounder than that of *C. occlusa*. At first the frontal wall is uniformly punctured as in *C. occlusa*, but with increased calcification it develops marginal areolae and an imperforate central area. In the specimens examined by me the beak of the vicarious avicularium of *C. areolata* has straight sides converging towards the hinge, and that of *C. occlusa* has curved sides with the narrowest part a little distal to the hinge. The mandible has this curved outline in both species.

Ortmann (1889, p. 42) introduced the name *Porella areolata* independently for a species unconnected with the present group. This would have priority if the genus *Cigclisula* were to be merged in *Porella*, but at present there is no need to suppress Kirkpatrick's name.

Livingstone (1926*b*, p. 247) recorded, as *Porella*, sp., a colony from the Capricorn Group, and described it as "closely allied to *Porella areolata*" and with characters "somewhat in accordance with *Mucronella mentalis*, Macgillivray" (1890*a*, p. 109). Its position remains uncertain.

Cigclisula cautium, sp. n. (Text-fig. 13, A–C.)

Porella areolata (erect specimens), Livingstone, 1926*a*, p. 91, pl. viii, figs. 2, 3.

Occurrence.—St. XIV.

Distribution.—Barrier Reef; Tsos Sima, Japan (B.M. 62.7.16.76).

Holotype.—St. XIV (B.M. 32.4.20.54).

Description.—The colonies consist of flattened branches that are narrower than those of most specimens of *C. occlusa*. The zooecia are longer than those of *C. occlusa*. The frontal wall from its first formation has marginal areolations and has its central part imperforate or with two or three pores, as in Livingstone's pl. viii, fig. 2. With increased calcification irregular lumps and processes are formed. As in *C. occlusa*, the orifice is variable in length, but it is usually longer and its proximal border is straighter than that of *C. occlusa* (Text-fig. 13, C). The mandibles of the peristomial avicularia (Text-fig. 13, B) are of the same type as those of *C. occlusa* and *C. areolata*, but those on the marginal zooecia are often large and triangular (Text-fig. 13, A) and placed in a plane perpendicular to the frontal surface, in such a way as to be conspicuous even in heavily calcified zooecia. The vicarious avicularia are long and rather slender, and small round avicularia occur sporadically on the frontal surface. The ovicells resemble those of *C. occlusa*, and the oral glands are of the peculiar type described in that species by Waters (1909, p. 152).

Remarks.—This species is distinguished from *C. areolata* by the absence of a uniformly perforate stage in the formation of the frontal wall, by the greater average length of the opercula, by the large, triangular, peristomial avicularia on some marginal zooecia, by the long slender vicarious avicularia with curved sides to the beak, and possibly by the erect branching form of the colony. It is distinguished from *C. occlusa* by the areolated frontal wall, the straighter proximal edge of the orifice and the large triangular avicularia. The oral avicularia of *C. occlusa* may be much enlarged, but these large avicularia do not occur specially on the marginal zooecia, they overhang the orifice and the mandible is spatulate (Text-figs. 13, D, E).

Livingstone does not state whether his figures were made from erect or encrusting specimens, but as figs. 2 and 3 agree with the present form, it may be surmised that they were made from erect ones. Fig. 4, on the other hand, agrees with the encrusting form, to which the name *C. areolata* is here restricted. It does not follow that all Livingstone's erect specimens belonged to *C. cautium*, but it seems probable.

Petraliidae.

A start has been made with sorting the Petraliidae into genera by the introduction of *Petraliella* and *Coleopora* by Canu and Bassler (1927*a*, pp. 5, 6). According to the usage of Canu and Bassler (1929, p. 255), all the Barrier Reef species would be placed in *Petraliella*, but as I am not satisfied that any of them is specially related to *P. bisinuata* (Smitt, 1873, p. 59), the genotype, I prefer to put them in *Petralia*, Macgillivray (1868, p. 141*), used in the old, wide sense.

Petralia chuakensis, Waters.

Petralia chuakensis, Waters, 1913, p. 518, pl. lxx, figs. 10–14; Livingstone, 1926*a*, p. 99.
Petrialella chuakensis, Canu and Bassler, 1929, pp. 251, 256, text-figs. 103F, 106B.

Occurrence.—Low Isles (shore).

Distribution.—Zanzibar, Torres Straits.

These specimens agree very closely with Waters's description and specimens. The only difference detected is that, instead of one large perforated area on the dorsal surface, there are a number of smaller ones, the largest usually being median and distal.

Mr. Livingstone points out that these specimens come from a muddy habitat similar to that of the ones recorded by him from Torres Straits.

Petralia vultur var. *serrata*, Livingstone. (Text-fig. 14.)

Petralia vultur var. *serrata*, Livingstone, 1926*a*, p. 95, pl. vi, figs. 7–10; 1927, p. 66.
Mucronella magnifica, Kirkpatrick, 1890*a*, p. 612.
Mucronella vultur, Thornely, 1905, p. 124.
? *Petralia aviculifera*, Marcus, 1922, p. 441, pl. xxv, figs. 12*a–f*.

Occurrence.—W. Low Is., 6 fath.; St. XII.

Distribution.—Ceylon; Barrier Reef; Murray Island, Torres Straits; Fitzroy Island, Queensland (B.M. 81.10.21.72); Holothuria Bank, N.W. Australia, 24-34 fath. (B.M. 92.1.28.68).

P. vultur var. *armata*, Waters (1913, p. 518) is described as having a pointed avicularium on the mucro, thus differing from Livingstone's varieties *serrata* and *bennetti*. Examining Waters's specimens I find, however, that the oral avicularia of var. *armata* are blunt with a toothed terminal flange, agreeing with his figure rather than his description. Seen obliquely under a low magnification, the flange gives the mandible the appearance of having a pointed, down-turned tip. A specimen of var. *serrata* from Peak Point (B.M. 31.10.12.6) sent by the Australian Museum has a few small round avicularia on the frontal wall, though not as many as in var. *armata*, and in the Barrier Reef specimens, which have all the types of avicularia, described in var. *serrata* by Livingstone, the small frontal avicularia are as numerous as in var. *armata*. Var. *serrata* is thus only distinguished by the presence of the long frontal avicularium. The Barrier Reef specimens differ slightly from both varieties in the orifice, which is wider than high, and has a wide median denticle.

Possibly these varieties should be regarded as specifically distinct from *P. vultur* (Hincks, 1882, p. 167, pl. viii, fig. 2), in which the avicularium on the mucro is fully visible in frontal view instead of being lateral, and the mandible ends in a down-turned point instead of being blunt with a toothed flange. A specimen from Port Phillip (B.M. 88.11.14.349) shows both these characteristics clearly.

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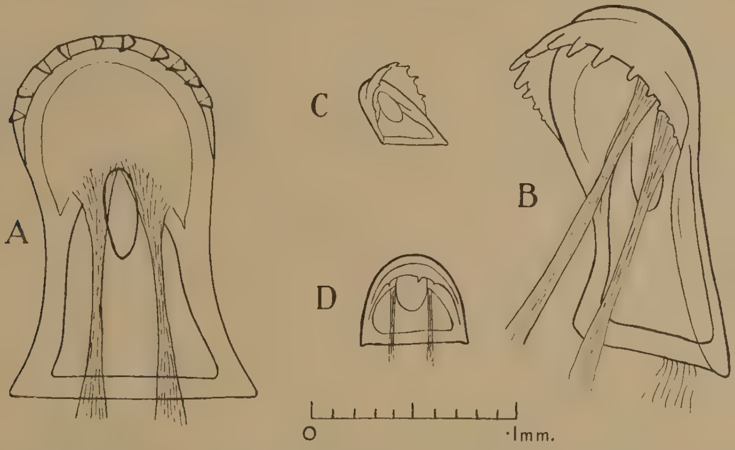
* Canu and Bassler (1929, p. 253) give the date of the introduction of *Petralia* as 1887. This is the date of the 'Catalogue of Marine Polyzoa,' in which MacGillivray (1887*b*, p. 212) gives a slightly enlarged definition of the genus. It is not only antedated by the original introduction (1868, p. 141), but also by the slightly modified repetition of this definition in McCoy's Prodromus (MacGillivray, 1881, p. 45). In all three works it comprises the single species *P. undata*. The selection of *P. japonica* as genotype by Canu and Bassler (1929, p. 253) is therefore invalid. Waters (1925, p. 541) recognized *P. undata* as the type.

The mandible of the small frontal avicularia resembles that of the oral ones in structure, having a pair of oblique sclerites passing from the lateral edges to the distal end of the lucida and having a toothed flange (Text-fig. 14, C, D). As in Livingstone's figure, the mandibles of the large spatulate frontal avicularia are untoothed, and have a median longitudinal sclerite meeting the two oblique sclerites. The edge of the concave part of the side is very finely beaded, *cf. P. chuakensis*, Waters (1913, pl. lxx, fig. 13). The oral mandibles (Text-fig. 14, A, B) have one of the lateral edges turned in and bordered by a sclerite. The opposite edge was never seen to be bent, and it appears that the mandibles are asymmetrical in this respect. The musculature is strong and the vesicle between the occlusor muscles large as in *P. litoralis*.

The specimen from Torres Straits (B.M. 90.3.24.38) recorded by Kirkpatrick (1890*a*, p. 612) as *Mucronella magnifica* proves to be a colony of *P. vultur* var. *serrata*, and examination of part of Thornely's specimen from the Gulf of Manaar in the Cambridge Museum confirms Livingstone's surmise that it could be identified with his variety. *Petraliella albirostris*, Canu and Bassler (1927*b*, p. 22), appears to be related, and resembles vars. *serrata* and *armata* in having numerous small frontal avicularia.



TEXT-FIG. 14.—*Petralia vultur* var. *serrata*, Livingst. Oral (A, B) and frontal (C, D) avicularia, oblique and basal views.

Marcus (1922, p. 441, *P. aviculifera*) had a form which appears to be very closely related to var. *serrata*. It resembles Livingstone's rather than my specimens in the orifice, which is longer than wide, with a narrow denticle. It has larger teeth on the small mandibles. Marcus identified it with *Mucronella aviculifera*, Hincks (1891, p. 297), but part of Hincks's specimen is in the British Museum (99.5.1.853), and is clearly distinct. The three slender columns by the orifice, one median proximal and two lateral distal, are exactly as figured by Hincks, and sometimes, at least, bear the minute avicularia shown by him. There is no trace of the distal spines, nor of the stout umbo with a lateral avicularium shown by Marcus. The median denticle of Hincks's specimen is very narrow, but the large frontal avicularia are blunt, not pointed as in Hincks's figure. They are raised, and may overhang the orifice. The zooecia are smaller and the orifice smaller and rounder than in Marcus's species.

Kirkpatrick's specimens of *P. thenardii* only differ from *P. aviculifera* (Hincks) in the branched proximal column. They have similar large frontal avicularia overhanging the orifice. They may, as suggested by Thornely (1905, p. 124), be the same species, as may also be *P. laccadivensis* (Robertson, 1921, p. 57).

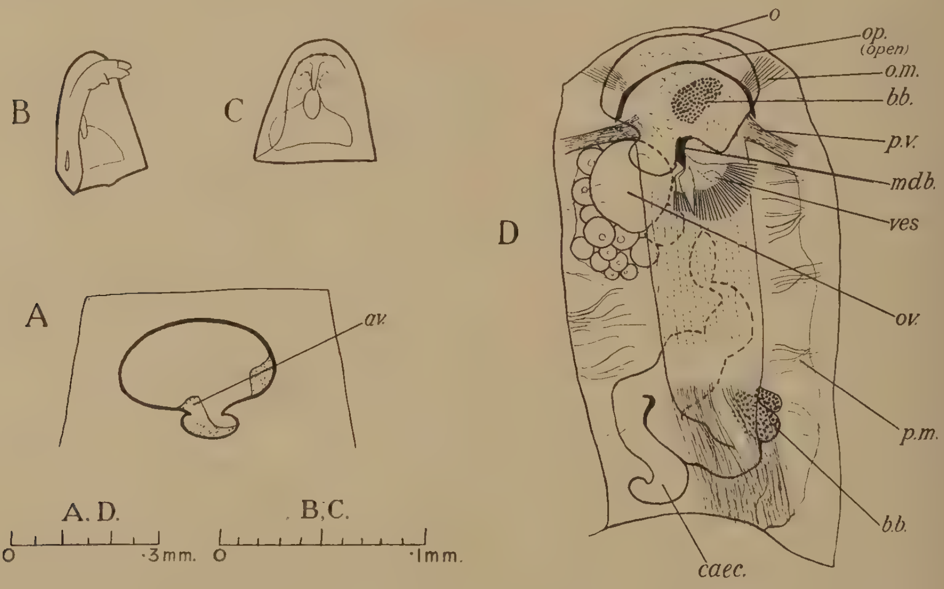
Petralia litoralis, Livingstone, sp. n. (Plate I, fig. A ; Text-fig. 15.)

Petralia litoralis, Livingstone MS.
? *Petralia elongata*, Canu and Bassler, 1929, p. 259, pl. xxiv, fig. 8.

Occurrence.—Low Isles (shore), off N. Anchorage.

Type.—Specimen from shore (B.M. 32.4.20.61).

Description.—The colony is unilamellar, and brown coloured even when preserved. In life the specimens were a chocolate-brown colour. The shore specimens are loosely encrusting, and were found under dead coral; the dredged one is unattached.



Text-fig. 15.—*Petralia litoralis*, Livingstone, sp. n. A, Orifice seen from within. Primary orifice thickly outlined, peristome and avicularium stippled. B, C, Oral mandible, oblique and basal views. D, Decalcified zooecium. *av.*, Avicularium. *b.b.*, Brown body. *caec.*, Caecum. *mdb.*, Mandible. *o.*, Orifice. *o.m.*, Occlusor muscle. *op.*, Operculum. *ov.*, Ovary. *p.m.*, Parietal muscle. *p.v.*, Parietovaginal muscle. *ves.*, Vesicle.

The orifice is more or less semicircular, with a sinus to one side. The sinus is limited by a pair of hinge teeth, of which one is longer than the other (Text-fig. 15, A). The smaller hinge tooth is almost in the median line and is hidden in frontal view by the oral avicularium. The larger hinge tooth and part of the sinus are visible in frontal view. The avicularium is placed transversely and has a hooked beak. The peristome is nodular and irregular, but forms a small umbo behind the avicularium. The ovicell has the usual finely punctured ectooecium. The ectooecium, which is uncalcified in young zooecia, becomes very unevenly calcified, sometimes forming radial calcareous bands (Plate I, fig. A).

On some zooecia there is a small, transverse, ligulate avicularium on the frontal wall (Plate I, fig. A). It is placed laterally and, though raised, is inconspicuous. The calcareous beak is hooked with a finely beaded edge. The mandible of the oral avicularium is bluntly triangular (Text-fig. 15, B, C). It has a toothed flange somewhat resembling that in *P. vultur* var. *serrata*, but more prominent distally. There are bosses for the attachment of the occlusor muscles, with a narrow longitudinal sclerite between them. As in the oral mandible of *P. vultur* var. *serrata*, described above, one of the lateral edges appears to be turned in. In the natural position of the mandible this edge is directed frontally. There is a rather large vesicle between the occlusor muscles (Text-fig. 15, D). Except for its greater length, the mandible of the frontal avicularium is like that of the oral avicularium.

The polypide (Text-fig. 15, D), like that of other Petraliidae, has a large number of long tentacles. The caecum is long and slender. The occlusor muscles of the operculum are attached to the distal wall. The parieto-vaginal muscles take the form of a single broad band on each side. The parietal and retractor muscles are very fine and numerous. There is a single ovary at one side of the zooecium. It has a large number of ova, of which one is usually much larger than the rest.

REMARKS.—Since Mr. Livingstone sent me his manuscript, Canu and Bassler's work on the Bryozoa of the Philippine Islands (1929) has been published, describing a large number of species of Petraliidae. Most of their new species differ from *P. litoralis* in possessing a lyrula. Of those that do not, *P. crassocirca* has a symmetrical orifice with a straight proximal border, an unraised peristome, and a rather conspicuous acute avicularium on each side of the orifice. This leaves *P. gigantea*, *P. grandicella* and *P. elongata*. The first two are larger in all their measurements, differ in the number and size of the dorsal radicular pores, and have larger and less numerous frontal pores. In its dimensions and in the size and number of the frontal pores *P. litoralis* resembles *P. elongata*. In *P. litoralis* there may be more than one dorsal pore, there are no avicularia on the "shield," and there may be a frontal avicularium. There are, however, large tracts in which no zooecium has a frontal avicularium. *P. litoralis* is thus very near to *P. elongata*, and, when the characters of *P. elongata* are more fully known, may be found to be synonymous with it.

Rhynchozoon longirostre (Hincks).

Rhynchopora longirostris, Hincks, 1881*c*, p. 125, pl. iv, figs. 7, 8; Waters, 1889, p. 19; Macgillivray, 1890*b*, pp. 356, pl. cxcvi, figs. 11–14; Kirkpatrick, 1890*a*, p. 612; Maplestone, 1909, p. 268.
Escharoides verruculata, Busk, 1884, p. 150.
Rhynchozoon longirostris, Hastings, 1930*a*, p. 729, pl. xiv, figs. 89, 90.

OCCURRENCE.—St. II.

DISTRIBUTION.—Australia, Heard Island.

There is one small colony of this species. The mandible of the large frontal avicularium sometimes extends beyond the beak and is somewhat expanded distally, but the beak is of the usual form. In all other respects the specimen is typical.

Retepora graeffei (Kirchenpauer).

Retihornera graeffei, Kirchenpauer, 1869, p. xxx.
Retepora producta, Busk, 1884, p. 108, pl. xxv, fig. 7; Waters, 1913, p. 525, pl. lxxii, figs. 9, 10 (synonymy); Marcus, 1922, p. 433.
Retepora graeffei, Marcus, 1921*a*, p. 15; Livingstone, 1927, p. 59.

Occurrence.—Box sunk in Anchorage, collected 29.v.29; N.W. Low Is.; off N. Anchorage; St. XII, XIV, XXVI.

Distribution.—N. Australia, Oceania, Indian Ocean.

This is *R. producta*, Busk. Following Marcus and Livingstone, Kirchenpauer's name is used, although the identity of Kirchenpauer's species with Busk's cannot be regarded as finally proved till the type has been examined. The specimen of *R. producta* in the British Museum, regarded by Waters as possibly the type of *R. graeffei*, is probably not the holotype. It is one of the specimens offered for sale (Mus. Godeffroy Cat. IV, p. 119, no. 3919), and was bought by the British Museum. On the title-page of Cat. III it is stated that the specimens for sale are duplicates and, as only two of the six species of *Retihornera* described by Kirchenpauer are offered for sale (Cat. IV, p. 119), it may be assumed that a series of specimens was retained in Hamburg. If so, these must be regarded as the holotypes.

Retepora monilifera var. *munita*, Hincks.

Retepora monilifera var. *munita*, Hincks, 1878, p. 361, pl. xix, fig. 5; Marcus, 1921*a*, p. 16, pl. i, figs. 6, 7; Livingstone, 1927, p. 58; 1928, p. 117.

Retepora monilifera form *munita*, MacGillivray, 1884*a*, p. 108, pl. i, fig. 3; 1885*b*, p. 22, pl. xciv, fig. 4, pl. xcvi, figs. 4–8; 1890*c*, p. 6; Kirkpatrick, 1890*a*, p. 612; Marcus, 1921*b*, p. 14.

Occurrence.—St. II.

Distribution.—Australia, Aru Is.

In these specimens the trabeculae are rather narrow and the fenestrae vary in width, some being a little wider, others narrower than the trabeculae. The vibices are conspicuous and enclose rather large areas. The opercula are longer than broad. They resemble those of *R. monilifera* in being fairly strongly chitinized, but are not wider proximally. The peristome is thick and raised on the older zooecia, forming a rather deep, wide sinus which frequently has an avicularium at one corner. These avicularia may have a very broad, short mandible, considerably less than a semicircle, with strong sclerites and a beaded edge, or a longer, less chitinized blunt mandible, as figured by Macgillivray (1884*a*, pl. i, fig. 4, small mandible on right). Both types of avicularia also occur on the frontal surface of the zooecia and on the edges of the fenestrae. The large suprafenestral avicularium has a strongly curved pointed mandible. The central part of the blade is thicker but without definite sclerites. The lateral thinner parts of the blade widen to form a blunt point on each side, thus differing from Macgillivray's figure, in which the mandible tapers uniformly. When the mandible is closed, the two points of the calcareous beak stand up between these lateral points and the terminal point. Similar avicularia occasionally replace the small ones on the frontal surface of the zooecia. They also occur on the basal surface, but here they are very flat. Those on the frontal surface have a prominent avicularian chamber. The ovicells are considerably taller than broad. The stigma is correspondingly elongated, sometimes the median arm, sometimes the two proximal ones being the longest. The angle between the proximal arms is acute. In Hincks's specimen of *munita* from Port Phillip Heads (B.M. 99.5.1.1257) the suprafenestral avicularium is larger, and the plane of its opesia is nearly at right angles to the plane of the mandible when closed.

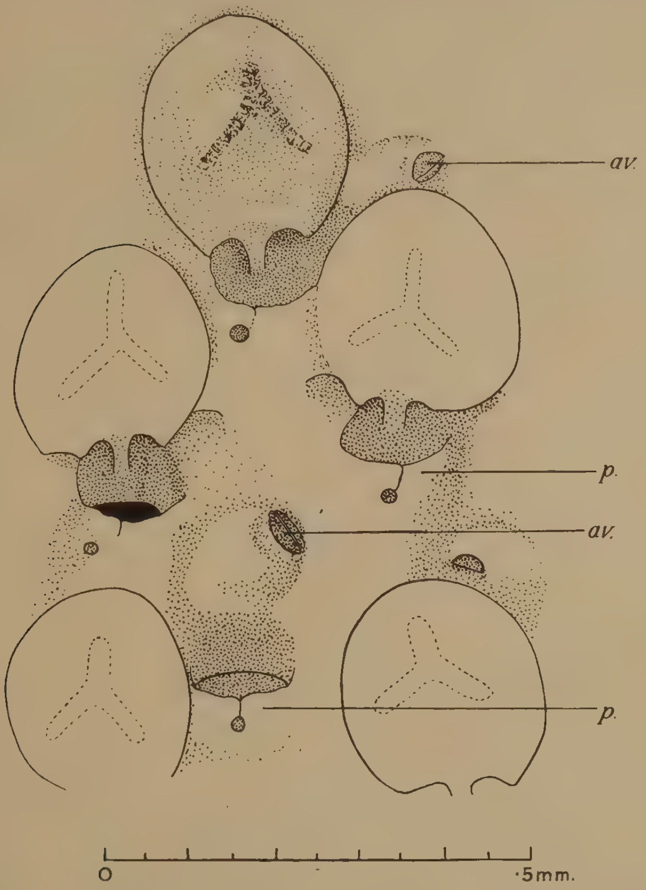
Retepora monilifera var. *benemunita* (Busk), var. nov. (Plate I, fig. E; Text-figs. 16, 17.)

Retepora benemunita, Busk MS.

Occurrence.—Australia (Busk Coll., B.M. 99.7.1.70, 71, 2930, 2952–2956, 4854; 82.7.29.82); Low Is., 12 fath.; off N. Anchorage; St. II, XII.

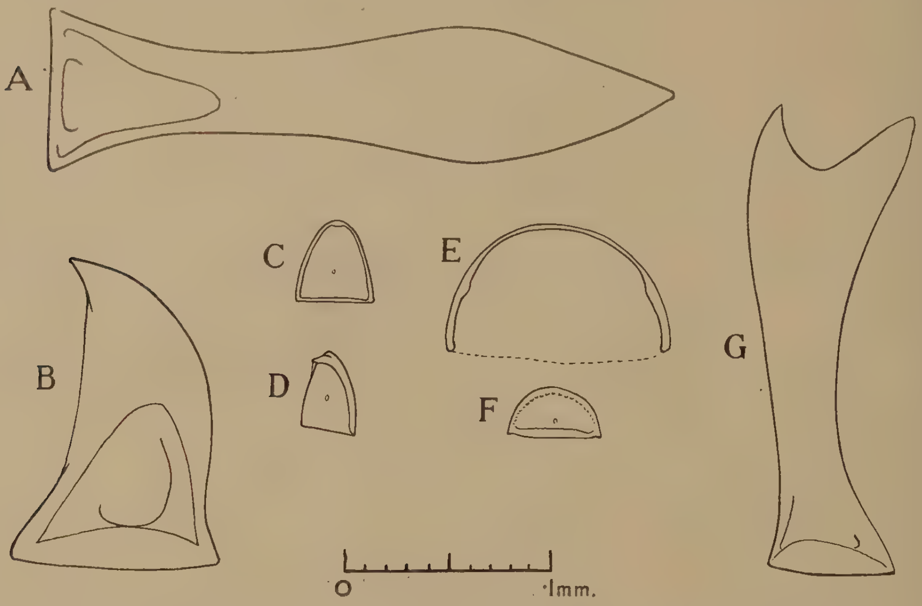
Type.—B.M. 99.7.1.70.

The type-colony (Plate I, fig. E) consists of irregular tubular meshes with the zooecia on their inner surface. In the Barrier Reef specimens the tubes may have a greater diameter, and occasionally the zooecia are on the outer surface. The fenestrae are regular, and usually a little narrower than the trabeculae. The dorsal surface has distinct vibices outlining rather large areas. The zooecia (Text-fig. 16) are very regularly arranged, and are rather long and narrow. They are thin-walled, and the peristome is thin and rather prominent. The two sides are united, making it very even in height, and leaving a pore. There may be a fine spine on each side of the orifice. The operculum is almost semicircular (Text-fig. 17, E). The peristome bears a triangular avicularium, whose mandible has a slightly down-turned point, and there may be a semicircular avicularium on the frontal wall (Text-fig. 17, C, D, F). In the type a few larger and more prominent avicularia with a



Text-fig. 16.—*Retepora monilifera* var. *benemunita* (Busk) var. n. Part of Barrier Reef specimen treated with Eau de Javelle and seen by reflected light. *av.*, Avicularium. *p.*, Peristome.

pointed, strongly curved mandible (Text-fig. 17, B) are found on both the frontal and the basal surface. These have not been found in the Barrier Reef specimens. There may be a raised avicularium directed into the proximal angle of the fenestra as in *R. tubulata.* Its mandible is bifid (Text-fig. 17G), and somewhat variable in shape; as a rule, however, its ends are shorter and less sharply pointed than those of *R. tubulata.* A few of these fenestral avicularia are present in the type, and they are common in other specimens. On the basal surface there are a few large avicularia with a long narrow mandible (Text-fig. 17, A), those of the Barrier Reef specimens being longer and narrower than those of the type. There are also small round ones bordering the fenestrae. The ovicells are prominent, and may be more or less spherical or a little longer than broad (Text-fig. 16). The longitudinal arm of the stigma is usually the shortest. The oral glands are rather conspicuous.



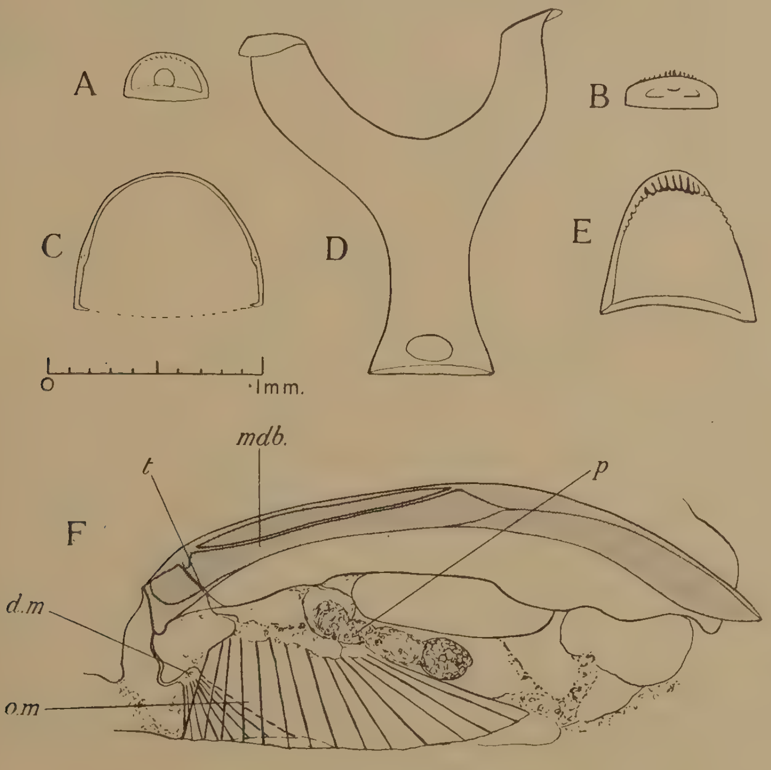
TEXT-FIG. 17.—*Retepora monilifera* var. *benemunita* (Busk), var. n. Chitinous parts of type. A, Mandible of large basal avicularium. B, Mandible of large triangular avicularium, oblique view. C, D, Oral mandible, frontal and oblique views. E, Operculum. F, Mandible of small frontal avicularium. G, Mandible of fenestral avicularium, oblique view.

The specimen from St. II differs in some ways. It agrees in the shape of the operculum and oral avicularium and in the presence of the bifid, proximal, fenestral avicularium. The peristome is thickened and somewhat pointed above the oral avicularium. The ovicell is slightly umbonate. There are a few large avicularia placed above the fenestra as in var. *munita*, but they have a bifid mandible, and the calcareous beak has three sharp points between which the tips of the mandible lie when it is closed. The mandible is long and slender, with long sharp points. As in var. *munita*, it is occasionally replaced by a highly chitinized semicircular mandible. The proximal fenestral avicularia are rather small and not very numerous in this specimen.

One specimen from St. XII has the characteristic zooecia, opercula and oral avicularium, but has no large fenestral avicularia. It has no ovicells. A dead specimen from the same station has the characteristic basal and fenestral avicularia.

Remarks.—This form is clearly allied to *R. monilifera*, but differs from the described varieties in the pointed oral avicularium, and, from most of them, in having an operculum that is wider than high (see Macgillivray, 1885*b*, pl. xciv, figs. 1, 2, 4, 5, though Marcus, 1921*a*, p. 17, regards the wide operculum as characteristic of the group). These two peculiarities, associated with the presence of a bifid fenestral avicularium and the general characteristics of the zooecia and ovicells, make necessary the introduction of a new name, which for the sake of uniformity with the present nomenclature in the *R. monilifera*-group may be regarded as designating a variety of *R. monilifera*. As the form was clearly recognized by Busk, under the manuscript name of *R. benemunita*, I have used that name and chosen one of Busk's two colonies as the holotype. In the Barrier Reef specimens collected in September, October and November, reproduction appears to be at its height, for the body cavities contain abundant eggs and sperm. In the specimens collected in February very few reproductive bodies have been seen. These colonies, in which the almost spherical oral glands are large and conspicuous, may have been formed from larvae produced the same summer.

Retepora tubulata, Busk. (Text-fig. 18.)



Text-fig. 18.—*Retepora tubulata*, Busk. a–e, Chitinous parts of type-specimen. f, Decalcified fenestral avicularium from Barrier Reef specimen, side view, mandible stippled. a, b, Mandible of semicircular avicularium, frontal and distal views. c, Operculum. d, Mandible of fenestral avicularium. e, Mandible of triangular avicularium. *d.m.*, Divaricator muscle. *mdb.*, Mandible. *o.m.*, Occlusor muscle. *p.*, Rudimentary polypide ? *t.*, Tendon of occlusor muscle.

Retepora tubulata, Busk, 1884, p. 121, pl. xxviii, fig. 2, text-fig. 32; MacGillivray, 1887*a*, p. 184; Thornely, 1905, p. 125; 1907, p. 193.
? *Retepora tubulata* var. Waters, 1913, p. 526.

OCCURRENCE.—St. II.

DISTRIBUTION.—Cape York, Malaya, Ceylon, Zanzibar?

Busk's figures do not show his usual accuracy, so the chitinous parts have been drawn again from his preparation (Text-fig. 18, A–E). It will be seen that the sides of the operculum are not curved inwards proximally, that the teeth on the triangular avicularia are large and closely set, and that the semicircular avicularia are also toothed. Except for variation in size of the triangular avicularia, the chitinous parts of the Barrier Reef specimen agree with them, but there are in addition a few avicularia on the margins of the fenestrae with very thin, semi-elliptic mandibles. The Barrier Reef colony has not begun to form the tubes characteristic of the zoarium of *R. tubulata*. It is young, but its growth has extended beyond the point where the tubular structure begins in the type. There is a fine spine on each side of the orifice. The "boat-shaped" avicularium (Text-fig. 18, F) is present in most of the fenestrae. The larger frontal avicularia are raised on short stout columns resembling the much taller and more numerous ones of *R. columnifera* (Busk, 1884, pl. xxvi, fig. 5*c*), which is very closely allied if not synonymous. It is difficult to know what Busk meant by the "numerous solid or tubular, calcareous, columnar processes, springing from the dorsal surface" for attachment in *R. columnifera*. Only two are visible in the type, and they do not differ from the secondary attachments of other *Reteporidae* (see Buchner, 1924, p. 160, text-fig. A).

Eggs and sperm can be seen in the body-cavities, and in some zooecia a pair of oral glands has been observed.

Holoporella mamillata (Busk). (Text-fig. 19, A–D.)

Cellepora mamillata, Busk, 1854, p. 87, pl. cxx, figs. 3–5; Hincks, 1881*a*, p. 267; Waters, 1887, p. 197; Philipps, 1899, p. 440; Thornely, 1912, p. 155; Marcus, 1921*b*, p. 18.

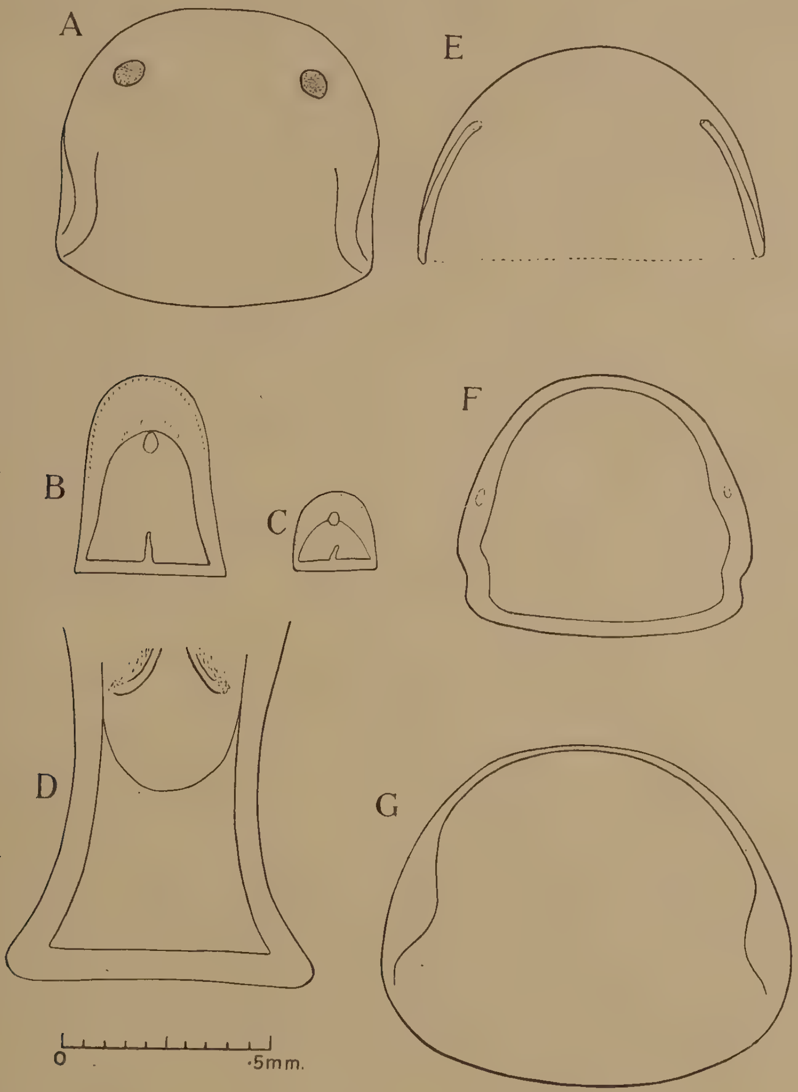
OCCURRENCE.—Low Is., 12 fath.; St. XIII, XXII.

DISTRIBUTION.—Australia, Malaya, Loyalty Islands, Indian Ocean, Patagonia.

These specimens agree very exactly with the type of *H. mamillata*. Busk (1884, p. 199) did not find the large "retentive" avicularia in Australian specimens, but a few are present in those from the Barrier Reef and are exactly like those of the type, the base of one of which is shown in Text-fig. 19, D. The spatulate and semicircular avicularia are like those of the type (Text-fig. 19, B, C), and show similar variation in the size of the lucida and the length of the columella. They have a delicate terminal flange, with a finely toothed edge. The spatulate mandibles vary a good deal in size. In the Barrier Reef specimens the opercula are a little larger and the lateral sclerite reaches the muscle attachment, which it can rarely be seen to do in the type (Text-fig. 19, A). This, the only distinction noted, can hardly be regarded as a specific difference. The muscle attachments in the type and the present specimens are nearer the distal end of the operculum than in the allied species.

The oral glands of the specimen from St. XXI resemble those described by Waters in species of *Holoporella* (1909, p. 165; 1913, p. 522, pl. lxxiii, fig. 11), being long and thin-walled, with homogeneous contents. Similar glands can be seen in Busk's preparation of *H. hastigera*.

A specimen from the Barrier Reef sent by Mr. Livingstone as *H. pigmentaria*, Waters (1909, p. 163), is the species here regarded as *H. mamillata*. The true *H. pigmentaria* appears to be more nearly allied to *H. mamillata* var. *atlantica*, Busk (1884, p. 199), which differs from typical *H. mamillata* in its operculum (Text-fig. 19, E). *H. pigmentaria*, which is described as resembling *H. mamillata* except for its operculum, has a similar operculum to that of var. *atlantica*, and might be expected to be synonymous with it. No columella is, however, shown in Waters's figures of the mandibles. *H. mamillata* may sometimes



Text-fig. 19.—*Holoporella.* Chitinous parts of: A–D, *H. mamillata* (Busk), type-specimen. E, *H. mamillata* var. *atlantica* (Busk), Challenger Coll., St. 148. F, *H. albirostris* (Busk), Challenger Coll., St. 151. G, *H. albirostris* (Hincks), Bass Strait.

have been confused with other pigmented Australian species, such as *H. albirostris*—a name which appears to have been given to two Australian species, both of which may be distinct from *H. albirostris* (Smitt, 1873, p. 70) from the Gulf of Mexico.

A specimen from the Tortugas (B.M. 31.12.19.35) appears to be Smitt's species. It differs from Smitt's description in its colourless opercula, but the degree of pigmentation in the dark species of *Holoporella* is variable, and the range of size of the orifice given by Smitt shows that he did not distinguish the large *H. magnifica*, Osburn (1914, p. 216), in which the opercula are black. The opercula of this Tortugas specimen of *H. albirostris* agree in size and shape with that figured by Canu and Bassler (1928*b*, p. 142, text-fig. 31A, B), but I have not seen the type shown in text-fig. 31C. The spatulate avicularia have a columella. *H. albirostris* (Busk, 1884, p. 193) has opercula (Text-fig. 19, F) and oral avicularia of a different shape. Canu and Bassler suggested that the difference in the opercula might be explained by distortion in Busk's preparation, but examination of the type slide shows that their shape is so regular and constant that one cannot suppose them to be distorted. The Mexican *H. albirostris* (Smitt) is therefore distinct from *H. albirostris* (Busk), though a specimen from Sydney (B.M. 62.2.4.35), believed to be the one mentioned by Smitt (1873, p. 70), agrees with *H. albirostris*, Busk. *H. albirostris* (Hincks, 1881*a*, p. 267), from Bass Strait, is represented in the British Museum (82.7.29.3; 99.7.1.3213, 3214, 3287) by specimens sent by Hincks to Busk, who (1881*b*, p. 362, explanation pl. xxvi; 1884, p. 193, synonymy) recognized their distinctness from his own species. *H. albirostris* (Hincks) differs from both Smitt's and Busk's species of that name in its opercula (Text-fig. 19G). They are larger and have no lateral sinuation. The lateral sclerite is thickened to form a rather knob-like flange, and the occlusor muscle is attached just distally to this thickening. A specimen from New Zealand (B.M. 75.1.5.51) also belongs to this species.

Busk (1881*a*, p. 344) distinguished *H. hastigera* from *H. albirostris* chiefly by the absence of spines. Examination of the types shows that their chitinous parts agree exactly, and that, although no spines can be seen in *H. hastigera*, some have been formed, for their basal chitinous joints remain. *H. hastigera* and *H. albirostris* (Busk) are thus probably synonymous as suggested by Waters (1885, p. 305), and should be called *H. hastigera*. The type-colonies of both species have ridges of the kind which, in its extreme development, gives *H. lirata* (Macgillivray, 1888, p. 250) its characteristic appearance.

Marcus (1921*a*, p. 24) has remarked on the improbability of *H. mamillata* being unknown to Macgillivray, and suggests that *H. verrucosa* (Macgillivray, 1888, p. 245) may be a synonym. It differs, however, in the shape of the operculum. A specimen in the Cambridge Museum determined by Macgillivray as *C. albirostris*, Smitt, appears to be *H. albirostris*, Busk (*H. hastigera*).

Holoporella intermedia (Macgillivray). (Text-fig. 20.)

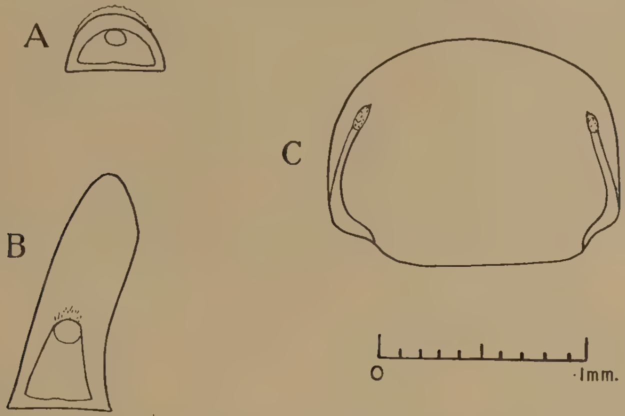
Cellepora intermedia, Macgillivray, 1869, p. 137; 1888, p. 247, pl. 166, fig. 3.

OCCURRENCE.—Off N. Anchorage.

DISTRIBUTION.—Queenscliff.

This unattached, irregularly mamillated, laminate colony, measuring 1½ in. by ¾ in., agrees with Macgillivray's description, except that the spatulate avicularia are not spoon-shaped, or specially large (Text-fig. 20, B).

The orifice is semicircular, with a rather conspicuous condyle at the proximal end of each side. The operculum (Text-fig. 20, C) is broader than long, and concave and a little thickened opposite the condyles. Many zooecia have no avicularium; others have a small one (Text-fig. 20, A) on a low eminence proximal to the orifice. In some parts of a colony in the Cambridge Museum these low eminences are developed into tall columnar processes. The zooecia of this colony also differ in having a slightly larger orifice.



TEXT-FIG. 20.—*Holoporella intermedia* (Macg.). A, Semicircular mandible, slightly distal view. B, Spatulate mandible, oblique view. C, Operculum.

Holoporella fusca (Busk).

Cellepora fusca, Busk, 1854, p. 88, pl. cxix, fig. 2; cxx, fig. 6; 1881*b*, pl. xxvi, fig. 11; 1884, pl. xxxv, fig. 14; Maplestone, 1882, p. 51; Macgillivray, 1888, p. 249, pl. clxvii, fig. 2; pl. clxviii, fig. 16; Kirkpatrick, 1890, p. 612.

Holoporella fusca, Waters, 1909, p. 161; Marcus, 1921*a*, p. 24, pl. i, figs. 11, 11*a*; Livingstone, 1927, p. 65.

OCCURRENCE.—St. XXII.

DISTRIBUTION.—Australia.

These specimens correspond exactly to Busk's description, figures and type-specimens. Macgillivray (1888, p. 249) had specimens which differed in having the spatulate avicularia directed upwards on the sides of conical rostra. In the type and in the Barrier Reef specimens the mandible is parallel to the surface of the colony.

Holoporella tridenticulata (Busk).

Cellepora tridenticulata, Busk, 1881*a*, p. 347; 1881*b*, pl. xxvi, fig. 9; 1884, p. 198, pls. xxix, fig. 3; xxxv, fig. 17; Macgillivray, 1890*c*, p. 6.

Holoporella tridenticulata, Thornely, 1912, p. 155; 1916, p. 164; Robertson, 1921, p. 61; Livingstone, 1927, p. 65; Canu and Bassler, 1930, p. 39, pl. vii, figs. 2 and 3 (references).

OCCURRENCE.—St. XII, XIII.

DISTRIBUTION.—Australia, Indian Ocean, Galapagos Islands.

This specimen agrees exactly with the type-specimen. The curious tubes mentioned by Busk, Thornely (1912), and Canu and Bassler, contain Spionid Polychaets, probably belonging to the genus *Polydora*. A similar Polychaet can be seen in one of the type-slides (B.M. 82.7.29.20).

Catenaria lafontii (Audouin).

Eucratea lafontii, Audouin, 1826, p. 242; Savigny, pl. xiii, figs. 2^{1-7}.
Catenaria lafontii, Hastings, 1927, p. 346 (references); 1930*a*, p. 732.
Savignyella lafontii, Osburn, 1927, p. 126.

Occurrence.—St. XVI.

Distribution.—Indian Ocean, Mediterranean, Atlantic, E. Pacific.

Vittaticella elegans (Busk).

Catenicella elegans, Busk, 1852*a*, p. 361, pl. i, fig. 2; Kirkpatrick, 1890*b*, p. 16; Thornely, 1905, p. 109; Marcus, 1922, p. 431, pl. xxiv, fig. 7 (references).
Vittaticella elegans, Okada, 1921, p. 27; Livingstone, 1927, p. 57; 1929, p. 99.

Occurrence.—St. II, VIII, XVI.

Distribution.—Australia, Tasmania (Cambridge Museum), New Zealand, Malaya, Japan, Indian Ocean, Tristan da Cunha.

The Barrier Reef specimens attributed to this species differ from the type-specimens in their slender zooecia, in the small size of their scapular (avicularian) chamber and in the arrangement of the vittae at the bifurcation. In typical *V. elegans* the vitta ("pedal-chamber") on the adzooecial side of the daughter-zooecium is short, and there is a boundary chamber (Levinsen, 1909, p. 256). In the Barrier Reef specimens the vitta is long, and has an expanded tip occupying the position of the boundary chamber of the type. This arrangement is well figured by Marcus (1922, pl. xxiv, fig. 7), whose specimens from the Aru Islands resembled those from the Barrier Reef. Like some of those from the Barrier Reef, Marcus's specimen had a large transverse avicularium on the adzooecial side of the daughter zooecium at a bifurcation. Other specimens whose zooecia resemble those of the Barrier Reef specimens rather than the type of *V. elegans*, and which possess this avicularium, are those of Waters (1913, p. 484) from Zanzibar, that from the Arafura Sea mentioned by Waters (B.M. 82.2.23.409), and Busk's specimens from S. Africa, mentioned (1852*a*, p. 361) as differing from *V. elegans*, and later (1852*b*, p. 10) identified with it. The existence of specimens only differing from these in the absence of the large avicularia is not surprising. Such are the "Challenger" specimen from St. 188 (Torres Straits), Kirkpatrick's from the same locality (1890*a*, p. 611), Thornely's from Ceylon (1905, p. 109), part of which is in the Cambridge Museum, and some from the Barrier Reef. Others, such as the "Challenger" specimens, except those from St. 188, are more definitely intermediate, and have led me to include both forms in *V. elegans*. They have the slender zooecia and small scapular chamber of the Barrier Reef specimens with the boundary chamber and short vitta of the type.

Macgillivray's description of *V. gracilenta* (1885*a*, p. 106, pl. i, fig. 3), suggests the Barrier Reef form, except that he does not mention a beaded border to the ovicell, or the presence of large avicularia, but his figure, which shows the long vitta on the adzooecial side of the daughter zooecium, represents a larger form. The long stout zooecia, with very wide vittae at the proximal end of his figured specimen, resemble the proximal zooecia of colonies of *V. gibbosa*; the whole figure might indeed represent a basal portion of a colony of that species. This suggestion is supported by the fact that in the first collection sent to the British Museum by Bracebridge Wilson this species is represented by specimens (B.M. 88.11.14.22, 28) which have a slight indication of the distal ridge of *V. gibbosa*, and in other respects agree exactly with the type-specimen of that species. Kirkpatrick's specimen of *V. gibbosa* from Torres Straits (B.M. 90.7.23.35) shows that there may be considerable variation in the degree of development of this ridge and of its spines. The supposed specimens of *V. gracilenta* in the second Bracebridge Wilson Collection (B.M. 97.5.1.46–50), received ten years later, are much smaller and more delicate than the species figured by Macgillivray, and have a boundary chamber and short vitta on the daughter zooecium as in typical *V. elegans*.

Another species resembling the Barrier Reef specimens in the long vitta of the daughter zooecium is *V. buskii* (Thomson, 1858, p. 139), of which I have examined part of the type material. It is, however, a larger, stouter species with large, sharply pointed scapular chambers on all but the more basal zooecia. Those of the distal zooecia are specially sharp and frequently are not avicularian. The basal zooecia show most clearly the cylindrical form and short joints described by Thomson. Those more distally placed taper proximally and have slightly longer joints. Marcus (1921*a*, p. 10) suggests that *V. buskii* may be a synonym of *V. gibbosa*, and he may be right. They agree in the size and general shape of the zooecia. *V. gibbosa* shows some tendency to form pointed scapular chambers, but in the material available to me they are shorter and always avicularian. *V. buskii* does not, in my experience, show any tendency to form a distal ridge with spines, and the " bottle-brush " form of its colony is, if constant, another minor distinction between it and *V. gibbosa*, in which such a form has not been found. A large and typical colony of *V. buskii*, recently obtained from the Hong-Kong Manilla cable (B.M. 30.1.9.6), shows this form very well (Plate I, fig. B), consisting of a number of very regular " bottle-brush " shoots branching from a strong stalk.

V. fusca (Macgillivray, 1884*b*, p. 33), which, according to Waters (1913, p. 483, footnote), is a synonym of *V. umbonata*, Busk (1852*b*, p. 11), resembles *V. buskii*, *V. gracilenta* and *V. gibbosa* in its long cylindrical basal zooecia with broad vittae, and in the arrangement of the vittae at a bifurcation. Like them it is larger and stouter than *V. elegans*. All these forms agree in the structure of their ovicells. In Thomson's figure of *V. buskii* the marginal beading appears to be continued across the lip, but this is not so in his specimen. There may be considerable variation, even within the colony, in the size and shape of the frontal uncalcified area, which may be large or small, quadrangular or oval. The marginal " beading " may be only a single row of pores, or there may be a few others scattered on the frontal surface. In this, too, there is individual variation. As both Marcus (1921*a*, p. 9) and Waters (1887, p. 87) expressed some uncertainty as to the meaning of Busk's statement that the " ooecial cell " is geminate, it may be worth remarking that Busk was not referring to the ovicell, but to the fertile zooecium, meaning that the ovicell-bearing zooecium is not separated by a joint from the one distal to it.

APPENDIX.

On a Hydroid Associated with the Polyzoa.

Zanclea protecta, Hastings.

Zanclea protecta, Hastings, 1930*b*, p. 552, text-figs. 1–6.

Occurrence.—Low Is., 12 fath., and N.E. Low Is. on *Schizomavella australis* ; off N. Anchorage on *Petralia litoralis* ; St. II on *Retepora tubulata* ; XIV on *Retepora graeffei* ; XXI on *Holoporella mamillata* ; IX on *Holoporella tridenticulata.*

Distribution.—E. Pacific, Tortugas on *Holoporella* spp. (B.M. 31.12.19.34.35).

One would expect the Barrier Reef specimens to belong to the allied species from Torres Straits, *Coryne cylindrica*, Kirkpatrick (1890*a*, p. 605), rather than *Z. protecta* from the Pacific. The type-material of *C. cylindrica* has, besides nematocysts resembling those of *Zanclea protecta*, considerable numbers of large ones of a different type. Their capsule measures ·032 × ·016 mm. and the thread is stout, about three times as long as the capsule, and spirally barbed. No such nematocysts are to be found in either the type-specimens of *Zanclea protecta* or the Barrier Reef specimens, which agree with the type-specimens exactly. The colony on *Retepora tubulata* commonly has a small medusa-bud in the angle between the hydranth and the hydrorhiza, thus differing slightly from the others.

The " parenchymatous cords " described by Waters (1888, p. 21, pl. iii, figs. 10, 10*a*) in *Retepora columnifera* from Torres Straits prove on examination of his slide (B.M. 89.12.12.2) to be the hydrorhiza of a hydroid of this type, typical hydranths also being present. Both hydranths and hydrorhiza contain large nematocysts resembling those of *C. cylindrica* except for their slightly smaller size, ·021 to ·017 × ·01 mm. It is presumably to be identified with *C. cylindrica.* The relation of the hydroid to the *Retepora* resembles that of *Zanclea protecta* to its host. Harmer (1909, p. 721 ; 1915, p. 12) discovered such an association of a Hydroid and *Retepora* in specimens from Malaya.

Kirkpatrick described *C. cylindrica* as forming a slender network on the basal surface of the Polyzoan and connected with the " heads of the hydroid " which projected from the frontal surface. Waters (1910, p. 254 ; 1913, p. 505) described a similar arrangement of a hydroid associated with *H. pigmentaria*, and concluded that the *Holoporella* had grown over and round established colonies of a free-living hydroid. No trace of a basal network has been found on any Polyzoa bearing *Zanclea protecta.*

Calcareous tubes similar to those described and figured (Hastings, 1930*b*) are frequently to be seen when examining Polyzoa, but in dry material the presence of the hydroid cannot be proved. The calcareous cups have not been seen in any species except *Smittina crosslandi*, but a small dry specimen of that species recently received from Ecuador (B.M. 31.12.8.2) bears two very much like those on the type.

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INDEX

(The principal references are in heavy type.)

PAGE
acanthina, Chaperia **412**
acanthina, Flustra 412
Acanthodesia **411**, 422
acaroensis, Smittina **431**
acuta, Lepralia 414
aegyptiaca, Loricaria 408
aegyptiacum, Synnotum **408**
Aetea **408**
albirostris, Holoporella 446
albirostris, Petraliella 437
alta, Nolella 399, **407**
altum, Cylindroecium 407
Amathia 402, **407**
ambita, Schizomavella 415, 417
ampla, Fenestrulina 429
ampla, Schizoporella 426
anatina, Lepralia 414
ancestrula 408, 411, 429
anguina, Aetea **408**
anguina, Sertularia 408
areolata, Cigclisula 432, **434**, 435
areolata, Porella 434, 435
armata, Petralia vultur var. 436
assimilis, Lepralia 418
atlantica, Farrella 407
atlantica, Holoporella mamillata var. 445
atlantica, Valkeria **407**
auriculata, Schizomavella 415, 417
australis, Hemeschara 417
australis, Schizomavella 403, 415, **417**, 450
aviculifera, Mucronella 437

Barentsia **402**
Beania **409**
benemunita, Retepora 441
bennetti, Petralia vultur var. 436
bisinuata, Petraliella 435
boryi, Caberea 403, **411**
boryi, Crisia 411
breve, Loxosoma **403**
brevipora, Cupuladria 412
Buskia **407**
buskii, Steganoporella **413**
buskii, Vittaticella 449

Caberea **411**
caliculata, Caulibugula 409
capitifera, Emballotheca 419
Catenaria **448**

PAGE
Caulibugula **408**
cautium, Cigclisula 434, **435**
cecilii, Schizoporella 422
Cellaria **413**
cernua, Pedicellina 401
cervicornis, Millepora 432
cervicornis, Scrupocellaria 411
Chaperia **412**
chuakensis, Petralia **436**, 437
Cigclisula 432
ciliata, Eschara 427
ciliata, Microporella **427**
circulare, Loxosoma 402, **403**
Codonella 415
Coleopora 435
columnifera, Retepora 444, 450
compacta, Pedicellina **403**
compressa, Millepora 432
compressa, Porella 432
convoluta, Amathia **407**
Coppingeria 402
cornea, Retepora 410
cornea, Retiflustra **410**
coronata, Membranipora 412
coronata, Setosellina **412**
Coryne 450
crassicauda, Loxosoma 402, 405
crassocirca, Petraliella 439
Crisia **405**
crosslandi, Smittina 450
Cupuladria **412**
cylindrica, Coryne 450

decussata, Crepis 422
Degeneration of polypide 423
delilii, Crisia 410
delilii, Scrupocellaria **410**
dendrograpta, Caulibugula **408**
dendrograpta, Stirparia 408
dentifera, Cupuladria 413
diadema, Scrupocellaria **410**
Didymozoum **410**
dimorphic opercula 416–418
distans, Hippothoa **426**

eburnea, Gemellipora 415
elegans, Catenicella 448
elegans, Vittaticella **448**
elongata, Crisia **405**

PAGE
elongata, Petralia 438
elongata, Petraliella 439
Emballotheca sp. **418**
Escharoides 432

fallax, Cosciniopsis 413
feegeensis, Hippopodina **413**
feegeensis, Lepralia 413
fissurata, Porella 433
flagellum, Hippothoa 426
fruticosa, Pedicellinopsis 401, 402
furcata, Emballotheca 419
furcata, Schizoporella 422
fusca, Cellepora 447
fusca, Holoporella **447**
fusca, Vittaticella 449

galeata, Lepralia 415
Gemellipora 415
gemelliporoides, Lepralia 415
genotype, Codonella 415
,, Emballotheca 420
,, Gemellipora 415
,, Lepralia 432
,, Petralia 436
,, Porella 432
,, Schizomavella 416
,, Schizopodrella 415
,, Schizoporella 415
,, Stylopoma 420
geometrica, Phylactella 431
gibbosa, Vittaticella 448
gigantea, Petraliella 439
glabra, Caberea 411
glabra, Gemellipora 415
gracilenta, Vittaticella 448
gracilis, Barentsia 401, **402**
gracilis, Cellaria 413
gracilis, Pedicellina 402
graeffei, Retepora 399, **439**, 450
graeffei, Retihornera 439
grandicella, Petraliella 439
grandis, Stylopoma 425
granulata, Lepralia 414
guineensis, Cupuladria **412**
guineensis, Cupularia 412

hastigera, Holoporella 444
Hippopodina **413**
Hippothoa **426**
Holoporella **444**, 450
horsti, Schizopodrella 430
hosteensis, Lacerna 430
Hydroid 450

PAGE
informata, Stylopoma 420, 424
intermedia, Cellepora 446
intermedia, Cupuladria 412
intermedia, Holoporella **446**

japonica, Petralia 436

kenozooecia 406, 408, 434

laccadivensis, Petralia 438
Lacerna 430
lafontii, Catenaria **448**
lafontii, Eucratea 448
landsborovii, Smittina 431
lata, Caberea **411**
lata, Schizomavella 415–417
lata, Schizoporella 416
laxa, Barentsia 401
Lepralia **414**, 418, 432
linearis, Schizoporella 415
lineatus, Loxocalyx 404
lirata, Holoporella 446
litoralis, Petralia 437, **438**, 450
longirostris, Rhynchopora 439
longirostris, Rhynchozoon **439**
Loxocalyx 399, **404**
Loxosoma 401, **403**

macandrei, Scrupocellaria 410
machaira, Schizoporella 418
maderensis, Scrupocellaria **410**
magnifica, Holoporella 446
magnifica, Mucronella 436
malayana, Sthenelais 404
malusii, Cellepora 427
malusii, Fenestrulina 427
malusii, Microporella **427**, 428
mamillata, Cellepora 444
mamillata, Holoporella **444**, 450
marmorea, Smittina 431
Mastigophora **426**
mentalis, Mucronella 435
Mesonea **406**
Mesopores 407
Metroperiella 416
Microporella **427**
monilifera var. benemunita, Retepora . 403, **441**
monilifera var. munita, Retepora 403, **440**, 442
montferrandii, Flustra 414
montferrandii, Lepralia **414**
mortoni, Lepralia 414
munita, Retepora monilifera var. . . . **440**
mutabilis, Microporella **427**
Myriozoum 432

PAGE
Nellia **410**
nitida, Lepralia 432
nivea, Schizoporella 422
Nolella **407**

obstructa, Smittina **431**
obtusata, Lepralia **414**
occlusa, Cigclisula 434, 435
occlusa, Escharoides 432
occlusa var. areolata, Lepralia 434
oculata, Nellia **410**
Oscarella 427
ovoidea, Schizomavella 422

palmata, Anguinella 407
papuensis, Nolella 407
parviporosa, Stylopoma 420
Pasythea 415
Pedicellina 401, **403**
pesanseris, Hippothoa 426
pesanseris, Mastigophora **426**
Petralia **436**
Petraliella 435
Petraliidae 435
Phascolosoma 402
philomela, Cribrilina 422
Phylactella **431**
pigmentaria, Holoporella 445, 450
Polychaeta 447
Polydora 447
Porella 432, 435
producta, Retepora 439
protecta, Zanclea **450**
pulcherrima, Idmonea 406
pulcherrima, Tubulipora **406**
punctata, Cellaria **413**
punctata, Salicornaria 413
pusillum, Loxosoma **403**

quadlingi, Parmularia 422
quadrata, Emballotheca 420
quadrilatera, Nellia oculata var 410

radians, Crisina 406
radians, Mesonea **406**
radians, Retepora 406
radicata, Diaperoecia 406
reproduction, Stylopoma 423
regularis, Beania **409**
Retepora **439**
Reteporidea 407
Retiflustra **410**
Rhynchozoon **439**
rozieri, Flustra 413
rozieri, Thalamoporella **413**

PAGE
sanguinea, Schizoporella 415
savartii, Acanthodesia **411**
savartii, Flustra 411
Schizomavella **415**
schizostoma, Lepralia 420
schizostoma, Schizoporella 420
schizostoma, Stylopoma **420**
Scrupocellaria **410**
serrata, Petralia vultur var. **436**
serrulata, Porina 434
setigera, Buskia **407**
Setosellina **412**
signata, Smittina **429**
simplex, Mesonea 407
sluiteri, Loxosoma 402
Smittina **429**
spatulata, Cellularia 411
spatulata, Scrupocellaria **411**
Sponge 427
spongites, Eschara 420
spongites, Stylopoma 422
Steganoporella **413**
stellata, Cupuladria 412
Sthenelais 404
Stylopoma **420**
subimmersa, Emballotheca 419
subsinuata, Schizoporella 418
Synnotum **408**

tenuis, Schizoporella 422
tergopores 407
Thalamoporella **413**
thenardii, Petralia 438
transversa, Caberea **411**
triangula, Schizomavella 415, 417
tridenticulata, Cellepora 447
tridenticulata, Holoporella **447**, 450
triseriale, Didymozoum **410**
triserialis, Didymia 410
trispinosa var. inaequalis, Smittia 431
truncata, Aetea **408**
truncata, Anguinaris 408
Trypostega **426**
tubulata, Retepora 442, **443**, 450
Tubulipora **406**

umbonata, Vittaticella 449
undata, Petralia 436
unicornis, Schizoporella 415

vacuoles 407
Valkeria **407**
velatum, Loxosoma 403
venusta, Lepralia 426

PAGE
venusta, Trypostega **426**
verrucosa, Holoporella 446
verruculata, Escharoides 439
verticalis, Cellepora 433
verticalis, Cigclisula 434
viride, Stylopoma **425**
viridis, Schizoporella 425
Vittaticella **448**
vultur, Mucronella 436

PAGE
vultur, var. armata, Petralia . . . 436
vultur var. bennetti, Petralia . . . 436
vultur var. serrata, Petralia . . **436**, 439

whiteleggii, Pedicellina 401
wilsoni, Amathia 402

Zanclea **450**
zanzibarensis, Caulibugula 408

DESCRIPTION OF PLATE I.

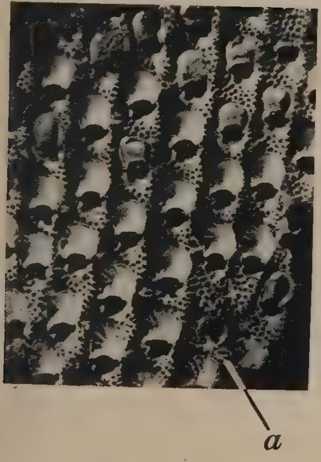
A, *Petralia litoralis,* Livingstone MS., sp. n. Type-specimen. × c. 10. Photograph by Mr. Livingstone. *a.*, Avicularium.

B, *Vittaticella buskii* (Wyv.-Thom.), from the Hong-Kong Manila Cable. Natural size.

C, *Schizomavella australis* (Haswell). Natural size.

D, *Microporella mutabilis,* sp. n. Type-specimen. Natural size.

E, *Retepora monilifera* var. *benemunita* (Busk MS.), var. n. Type-specimen. Natural size.



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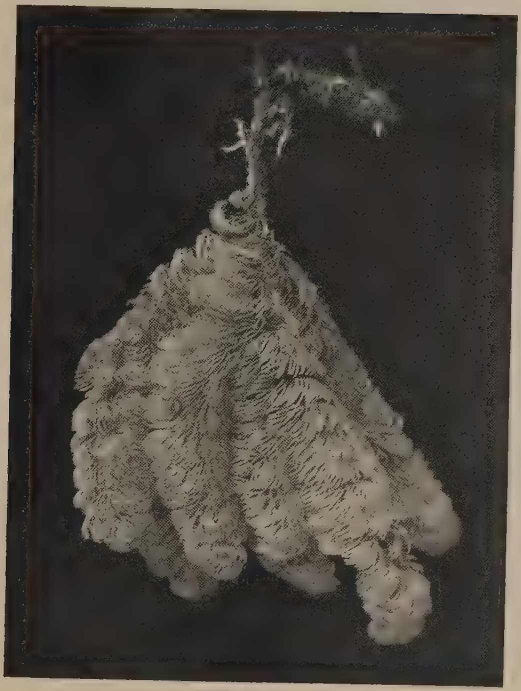

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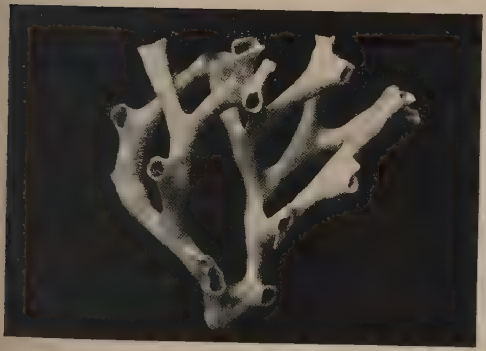

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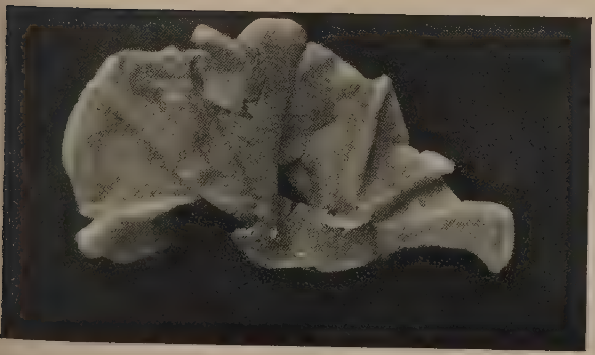

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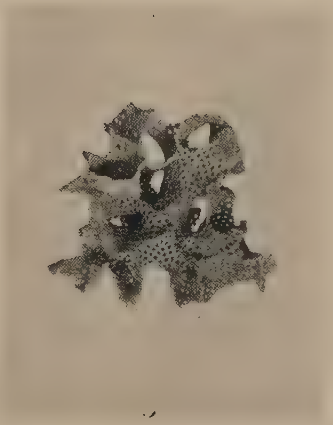

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GORGONACEA

BY

SYDNEY J. HICKSON, F.R.S.

WITH TWENTY TEXT-FIGURES

CONTENTS

PAGE.
1. Introduction . . . 459
2. List of Species . . . 465
3. Epizoites . . . 466
4. Description of Species: . . . 467
    Suberogorgiidae . . . 467
    Melitodidae . . . 469
    Isididae . . . 470
    Plexauridae . . . 470
    Muriceidae . . . 475
    Acanthogorgiidae . . . 501
    Gorgonellidae . . . 502
5. References . . . 510
6. Index . . . 512

1. INTRODUCTION.

The naturalists of the expedition have reported that Gorgonids are rare on the Barrier Reef (Yonge, 1930, p. 133), and that only two species, a *Juncella* and a *Melitodes*, could be found at Low Isles, and that these were apparently confined to shaded or overhanging surfaces on the seaward slope and formed no part of the ordinary surface fauna (Stephenson, 1931, p. 71). The collection sent to me confirms these reports as a general statement of fact, but there is one locality investigated which bears a very rich fauna of Gorgonacea.

In the Penguin Channel no less than 42 specimens were obtained from two stations, and these may be referred to 9 genera and 15 species. The short and narrow "Penguin" Channel lies between Snapper Island and the mainland. It is about 7 miles N.W. of Low Isles, and is 13–14 fathoms deep, with a rocky bottom. An important feature of this channel, which may account for the fact that it is two or three fathoms deeper than the sea between Snapper Island and Low Isles and for its clean-swept bottom, is that the flood tide flows from south to north directly through the channel and that the ebb tide creates an eddy round the island, so that there is a flow of water in the same direction during the ebb.

A flow of water therefore in one direction over a rocky bottom seems to be favourable to the growth of Gorgonacean corals.*

A strange contrast to this is to be found in Panama Bay, where the Gorgonacea flourish abundantly in an open and very muddy sea (Hickson, 1928, p. 326).

There are no species common to the two regions, but in both there are Gorgonians with lax ramification, and with flabellate ramifications with anastomoses and without anastomoses. The bushy form of ramification which is very common among the Gorgonacea of Panama Bay is not represented in any of the specimens collected in the Penguin Channel.

Our knowledge of the Gorgonacean fauna of the Barrier Reef is very scanty. Ridley (1884) described 22 species collected between Torres Straits and Port Curtis, and of these 14 were Holaxonia and 8 Scleraxonia.

In this report I have recorded 19 species, of which 17 are Holaxonia and only 2 Scleraxonia. Six of these species are probably identical with species described by Ridley. All the others, with the exception of *Isis hippuris* and *Melitodes ochracea* previously described by Saville Kent, have not been recorded from this region.

Owing to the great difficulty of identifying the species of some of the genera of Gorgonacea, to be discussed later, these figures represent opinions rather than facts. The most interesting point in the statement is that Ridley recorded 8 species of Scleraxonia, and that there are only two in this report. It was a surprise to find in the collection no representatives of such genera as *Siphonogorgia*, *Solenocaulon*, *Alertigorgia*, *Mopsella* and *Acabaria*. The species described by Ridley as *Leptogorgia australiensis* (since referred by Kükenthal [1919, p. 854] to the genus *Pseudopterogorgia*) seems to be very common on some parts of the reef, but is not represented in the collection.

Some of the species presented no difficulty in determination. *Isis hippuris* and *Melitodes ochracea* can be recognized at once by several distinguishing characters and seem to show little variation. Most of the others in the collection, however, could be given generic and specific names only with some doubt, and after long and tedious research in the vast literature of the subject. These difficulties have arisen in consequence of the overlapping in characters of the families and the genera into which the Holaxonia have been artificially separated, and to the description of many new species on quite insufficient grounds.

In a previous paper (1930, p. 248) I have pointed out that, apart from the family Isididae, which stands by itself, the families of the Holaxonia, which are generally recognized cannot be separated from one another by any one clearly defined character nor by two or more characters in combination. Some species referred to the Plexauridae, for example, have characters which are almost identical with those of the Gorgoniiade (Hickson, 1928, pp. 339, 340), and others have characters almost identical with those of

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* There were only two dredging stations in Penguin Channel, Station IX, 22.ii.29, 12–14 fathoms, in a clean pit and on mud at sides; six dredges about 20 mins. each: and Station XII, 24.ii.29, 10–15½ fathoms, rock and shell gravel, mud on edges of the pit; five dredges of about 20 mins. each. To avoid repetition the numbers only of these stations are referred to in the text.

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the Muriceidae. Some of the species of the genus *Plexauroides*, usually included in the family Plexauridae, appear to be identical with species of the Muriceid genus *Echinogorgia* (see p. 498), and there are no characters which have yet been described to distinguish *Euplexaura robusta* from the Muriceid genus *Discogorgia* (see p. 474).

The result has been that some species of a genus have been redescribed as " new species " of a different genus and attributed to a different family.

The rapid multiplication of generic names which has taken place of recent years, based, in many cases, on some slight variation in one character (*e. g.* the spicules), has led to unnecessary confusion and difficulty.

The number of supposed new species, many of which have been very inadequately described, has increased to such an extent that the task of attempting to determine a specimen from a new locality is almost overwhelming. The pronounced tendency to increase the number of genera and species in this group of families is due, in no small measure, to faith in the size and detailed characters of the spicules as a guide to generic and specific diagnosis.

There can be no doubt that in some cases the spicules of Alcyonaria (*e. g.* the club-shaped spicules of *Juncella*, the " torches " of *Eunicella*, the scales of many Primnoidae, etc.) are very valuable guides for the distinction of genera or species ; but in others they are so variable, both in the individual and the species, that great discretion is needed in the use of them for systematic purposes. An investigation of the specimens of the genera *Plexauroides* and *Echinogorgia* in this collection lends support to the view that the spicules are far more variable than is usually supposed.

There are 14 specimens of these closely related genera from the Penguin Channel. They all possess a superficial layer of spicules of the type known as " Blattkeulen " (see p. 481). An examination of preparations of all these specimens shows that no two of them were exactly alike as regards the spicules of the coenenchym, and not one of them is exactly in agreement with the description of the spicules of any of the numerous species of the genera hitherto described.

If the principles of classification used by many previous writers on the subject had been adopted, I should have had to propose 14 new species based on the examination of one specimen of each species. To suppose that the naturalists of the Expedition in the course of two days collected only one specimen of each of 15 distinct species in this very small channel is, however, absurd.

Kükenthal (1910) and Broch (1916) have described 8 new species of the genus *Plexauroides* from Sharks Bay and Cape Jaubert in W. Australia at approximately the same depth. These two localities are less than 200 miles apart. There were 3 specimens of one species, but only one specimen of each of the others. Here, again, it seems very remarkable that only one specimen of each of 7 species, which are supposed to be distinct, was obtained in such a limited geographical and bathymetrical range.

Other examples could be given similar to the above, all of which indicate that many of the new species must be only local varieties of a much smaller number. In some Gorgoniidae the spicules are of the same general form and maximum size throughout the whole colony, but when spicules of different specimens of the same species are examined, small but quite appreciable differences are found (Hickson, 1928, pp. 374, 377, 387). The case of *Gorgonia stenobrochis* was of particular interest, because it is quite distinct from the other species of this genus and 7 specimens from the same pool were examined. If these specimens had been found in different localities, and reliance had been placed on small differences in the spicules without consideration of other characters, several new species might have been proposed.

It is the same with the Muriceids. Many of the genera have spicules of a definite type, such as the " Blattkeulen " of *Echinogorgia*, the dagger-shaped spicules of *Acanthogorgia*, the disc-shaped spicules of *Bebryce*, etc., but the exact size, the details of structure, the tuberculation and other characters vary in every species, and to some extent in every individual.

There are two main influences that determine the size and appearance of the fully-formed spicule. The force of heredity which gives the spicule the generalized type of the genus or species, *i. e.* the club, the spindle, the capstan, the " Blattkeule," etc., and the external forces which determine the exact size and the final detailed form of such processes as tubercles, spine, foliate expansions, etc.

Woodland (1905, pp. 16, 17), in his valuable study of the development of the spicules of *Alcyonium*, laid down two principles: (1) That the growing spicules are subject to an aggregate of tendencies which tend to produce irregularities of form. (2) That the extension of a growing body into a surrounding resistant body is most easily effected by the protrusion of more or less acute processes which, in virtue of their acuteness, are best able to cleave a passage.

That the form of the spicules of certain sponges is also influenced by external forces was shown in an interesting paper by Dendy and Nicholson (1917, p. 573). On these principles the ultimate structure of an individual spicule in such a position as the surface of the verrucae or coenenchym of the Muriceidae, where the spicules are crowded together, depends upon its site and its relation to neighbouring spicules.

The spicules round the aperture of a verruca, for example, may bear a spine, *e. g. Acanthogorgia*, which is much more prominent than it is on the spicules at the base of the verruca, and it is very tempting to assume that the latter correspond with a developmental stage of the former. The study of the spicules of young verrucae suggests that they are (Gordon, 1926), in some cases, but there can be no doubt that the development of any spicule is influenced to some extent from the earliest stages by the position it occupies in relation to other spicules and environmental forces.

The process of development of a spicule cannot be studied in prepared material in the same way as the development of a frog can be observed from the live egg to the live tadpole stage; it is only an inference, which may be misleading, that the smaller spicules in a preparation represent earlier stages in the development of the larger ones.

But even if we cannot trace the development of a particular type of spicule in detail, the study of smaller spicules of the type often affords valuable evidence of the value of the full-grown spicule for the determination of specific characters (*cf.* p. 481), as they may correspond with a developmental stage in the growth of the spicule.

If there is some modification of the details of the structure of spicules due to the influence of immediate surroundings, it should be particularly noticeable in those parts of the spicules of the Muriceidae which project from the surface of the coenenchym. Such processes have not to force their way through the dense coenenchym, but are subject to the varied influences of the currents of water and its contents which pass over the surface of the Alcyonarian and other conditions of their site.

When a large number of the spicules of a genus bearing such spicules is examined, a very remarkable range of variation is seen as regards the detailed structure of the processes, such as the arrangement of the leaves, the number of tubercles, the length of the spines, etc. It is, indeed, difficult to find two spicules that are exactly alike.

This variability of the spicules in the Gorgonacea does not seem to have been usually recognized in systematic work, with the result that several new species have been described, based on the minor and variable characters of one specimen.

In the key plan of the species of *Echinogorgia*, for example, given by Kükenthal (1924, p. 198), the difference between three species of the genus is that in *E. complexa* the leaves of the Blattkeulen are in rows, in *E. furfuracea* they are radial, and in *E. ridleyi* in concentric circles.

On an examination of a large number of spicules from a single specimen referred to the species *E. furfuracea* in the collection, all three of these arrangements of the leaves can be found, as well as many others that are more irregular.

The value of the mode of ramification, as a character of the species, is difficult to determine, and particularly so as regards small specimens 100 mm. or less in height.

There can be no doubt that external influences, such as the strength and direction of the sea current, neighbouring corals and other zoophytes, etc., must influence the detailed growth of the branches ; but, in my experience, the general forms of unbranched, or lax, or flabellate or reticulate ramifications are good characters for systematic determinations. The two small forms of *Ctenocella* described later (p. 509) afford an interesting confirmation of this view.

The entire lack of knowledge of the development of the colonies of these Alcyonaria renders the correct identification of small colonies very difficult. An unbranched specimen 50 mm. high might have remained unbranched like a *Juncella juncea*, or it might have given rise to a flabellum with or without anastomoses.

There are two specimens referred to the species *Echinogorgia furfuracea* in the collection, which are alike in other respects, but the larger one (160 mm. high) has anastomosing branches, and the smaller (100 mm. high) has no anastomoses between the branches. The larger specimen of *Plexauroides rigida* (180 mm. high) has a lax method of branching ; the smaller one (70 mm. high) is unbranched. An investigation, which could only be carried out when a large number of specimens of the same species from the same locality are available, to determine the size or age at which the young forms assume the characteristic form of branching of the adult, would be of great value, and would probably lead to a considerable reduction in the number of redundant species.

In this collection ten stems 2·5–40 mm high arising from a common base of *Euplexaura robusta* (Spec. D) are unbranched, but a stem 65 mm. in length has branches in the same plane (see p. 471 and Text-fig. 1).

Colour.—The investigation of the colour of the specimens in this collection confirms the opinion I expressed (1928, pp. 360 and 399) in the description of the species of *Muricea* and *Leptogorgia* from Panama, that colour may be a fixed character and of considerable value in systematic work.

There are various shades of red, passing from pale pink to coral red, and to orange and yellow, which may be interchangeable, but the distinction between coloured and white or colourless seems to be fixed. The pigment which colours the spicules is either present or absent. When present it may be confined to the spicules at the surface of the coenenchym which are fully exposed to the light, or it may be present in all the spicules of the colony, but the species without any colour in any of the spicules seem to be distinct from those with colour in some or all of the spicules.

The colour of living Alcyonaria is often different to the colour of preserved specimens of the same species. This is due to the presence of soluble pigments in the coenenchym, and of these we have very little knowledge at present.

The evidence seems to be conclusive that in several of the genera of the Gorgonacea there is considerable variation in the characters which are used for systematic purposes, and the of idfficulty distinguishing true species from mere varieties is almost insuperable. The number of specimens from any locality collected by the research expeditions is usually quite insufficient to throw any light on the matter. Moreover a complete account of the characters of the fully expanded polyps is impossible when the specimens sent home for examination are completely contracted. A study of the size, structure and armature of the anthocodiae would probably yield very valuable results.

The time and resources of these expeditions are not usually sufficient to provide expanded material of the kind required on a large scale, but an intensive study of one species or group of varieties in one locality would give us a very welcome addition to our knowledge of this group.

The possibility of hybridization must always be borne in mind, and therefore a record of the gonads should always be made, and the date on which the specimens were collected. The few facts that have been collected seem to indicate that most of the Gorgonacea of the Penguin Channel spawn at the same time of the year, and that therefore hybridization is not impossible. If it can be shown that two closely related forms breed at different times of the year and hybridization is thus rendered impossible, there would be one good reason for regarding them as distinct species.

Gonads.—Most of the specimens in the collections were examined by means of whole mounts decalcified and cleared in oil, to determine the size and sex of the gonads if they were present.

By this method gonads 0·05 mm. in diameter can be easily seen and their size and sex determined. Series of sections show in some cases gonads of still smaller size, but it seemed to me unnecessary, for my purpose, to devote so much time to cutting sections of all the specimens as this would have involved. In the Alcyonarian colonies the sex and stage in oogenesis or spermagenesis is usually the same throughout, so that a sample taken from any part or branch except the growing tips gives the sex and state of maturity of the colony as a whole. I have not discovered any case in which different parts of a colony were not of the same sex, and in these Gorgonians from the Barrier Reef there were no examples of hermaphroditism nor of viviparity. It is possible that some branches of a colony that bears gonads elsewhere may be barren, and that some of the specimens in which no gonads were observed may not be barren throughout. That is a possibility which should not be lost sight of in the following discussion of results.

The specimens collected in the Penguin Channel on 22nd and 24th February, 1929, are 42 in number, and they are referred to 14 species in this report. Of these, 33 were examined for gonads; 6 duplicates of *Euplexaura robusta* and 3 duplicates of *Muricella tenera* were not examined. In 13 out of the 33 specimens examined no gonads were observed.

Of the 20 specimens with gonads, 14 are male and 6 female. In only one specimen (*Plexauroides praelonga*) is the gonad nearly mature; in all the others they are immature, varying from 0·1 to 0·3 mm. in diameter. There are 8 specimens referred to 6 species which were dredged outside the Penguin Channel. *Suberogorgia appressa* from the Pasco Reef collected in March, *Acanthogorgia studeri* from the Papuan passage also in March, *Melitodes ocharcea* and *Isis hippuris* from the Low Isles in February and May, were apparently all barren. The specimen of *Muricella perramosa* from the Linden Bank collected in November had small male gonads, and *Isis hippuris* from Lizard Island in July, ripe male gonads. A male specimen of *Ctenocella pectinata* taken in February on the Wentworth Reef had the gonads nearly ripe, and 0·5 mm. in diameter. As a small female specimen of the same species collected on the following day in the Penguin Channel had relatively large ova (0·4 mm.), it may be that this species spawns earlier than the other species of this part of the reef.

As the number of observations is very small, no definite conclusions can be drawn from these facts, but they seem to indicate that most of the Gorgonians of the Penguin Channel are in approximately the same sexual stage in the month of February, and that therefore they spawn at some later time. There is no evidence at present as to the time when they do spawn ; but if I were asked my opinion, I should say probably June or July.

Our knowledge of sexual questions in the Alcyonaria is very meagre, but in some species several months (six months in the case of *Alcyonium digitatum*) elapse from the time when the gonads are first visible to the naked eye until they are mature. In this connection it is of some interest to note that one specimen of *Isis hippuris* collected off Lizard Island on 3rd July was sexually mature with gonads 0·45 mm. in diameter.

There is no evidence as to the size or age at which these Alcyonarians reach sexual maturity. The smallest specimen in the collection of *Euplexaura robusta* (specimen x), was a male with testes only a little smaller than those of other specimens of the same species.

Of the two small specimens of *Ctenocella pectinata* from Penguin Channel, one was a female with comparatively large ova (0·4 mm.). The very small (55 mm. high) specimen of *Echinogorgia sasappo* has male gonads as large as those of the larger specimen.

My thanks are due to Prof. Stanley Gardiner for giving me facilities to work in the Zoological Department in the University of Cambridge, to Capt. Totton, Dr. A. Hastings and Mr. Robson for assistance in identifying specimens in the British Museum, to Dr. S. Manton for information concerning the localities on the reef, and to Miss J. Gardiner for drawing many of the illustrations.

2. LIST OF SPECIES.

The following is a complete list of the species in the collection :

Sub-Order SCLERAXONIA.

Family *Suberogorgiidae.*

Suberogorgia appressa, Nutting. 1 specimen.

Family *Melitodidae.*

Melitodes ochracea, L. 2 specimens ; P.

Sub-Order Holaxonia.

Family *Isididae.*

Isis hippuris, L. 3 specimens.

Family *Plexauridae.*

Euplexaura robusta, Kükth. 13 specimens ; P.

Family *Muriceidae.*

Muricella perramosa, Ridley. 1 specimen.
Muricella tenera, Ridley. 8 specimens ; P.
Echinogorgia sasappo, Esper. 2 specimens ; P.
Echinogorgia furfuracea, Esper. 2 specimens ; P.
Echinogorgia sphaerophora, Kükth. 1 specimen ; P
Echinogorgia reticulata, Esper. 2 specimens ; P.
Echinogorgia umbratica, Esper. 1 specimen ; P.
Plexauroides rigida, Kükth. 2 specimens ; P.
Plexauroides praelonga var. *typica*, Ridley. 2 specimens ; P.
Plexauroides praelonga var. *cinerea*, Ridley. 2 specimens ; P
Echinomuricea indo-malaccensis, Ridley. 1 specimen ; P.
Paramuricea (?). 1 specimen ; juv. ; P.

Family *Acanthogorgiidae.*

Acanthogorgia studeri, Nutting. 1 specimen.

Family *Gorgonellidae.*

Juncella gemmacea, Val. 2 branches ; P.
Scirpearia elongata, Pall. 1 specimen ; P.
Ctenocella pectinata, Pall. 3 specimens ; P.

Note.—The letter "P." at the end of the line signifies that the species was dredged in the Penguin Channel.

3. EPIZOITES.

Most of the Alcyonaria in the collection are quite clean, but on some there is a rich fauna and flora of epizoic organisms. None of these seem to be destructive in nature, but in most cases are confined to the dead or dying stems and branches, taking advantage of the firm support of the exposed axis.

In a few specimens there is a small growth of sponge over the coenenchym that looks normal, but these are the only cases in which the epizoites appeared to have a smothering effect.

Attached to an *Echinogorgia reticulata* (f) were two specimens of the Pelecypod *Pteria marmorata*, each about 65 mm. in length. Another specimen of the same size was attached to a specimen of *Muricella tenera* (g), and two small ones (16 and 18 mm. in length) were attached to another specimen of the same species of *Muricella* (Q). These molluscs modified to some extent the normal ramification, but did not affect to any serious degree the general well-being of the colony (Text-fig. 4). Attached to the bare axis at the base of the stem and branches of the *Echinogorgia reticulata* (F) there are growths of Zoanthids, Sponges, Polyzoa, Hydrozoa, and a few small specimens of the interesting Tunicate *Didemnum grande* of Herdman, whose minute, densely crowded calcareous spicules give it the superficial appearance of an encrusting Foraminifer. A small simple Ascidian (15 mm. in height) was found on some of the branches.

Mixed with this varied fauna on the stem are some long filaments which I believe are algae. Among a similar fauna attached to the stem of the specimen of *Echinomuricea*, I found some small colonies of *Rhabdopleura* with the zooids beautifully preserved. The *Pteria* shells attached to these Gorgonians also bear a rich epizoic fauna, including two species of special interest. One is a fine specimen of the encrusting Polyzoon *Petralia vultur* var. *serrata*, Livingstone, and the other a diminutive Alcyonarian without spicules which I think should be referred to the species *Clavularia margaretiferae* of Thomson and Henderson.

4. DESCRIPTION OF SPECIES.

Sub-Order SCLERAXONIA.

Family Suberogorgiidae.

Suberogorgia appressa, Nutting.

An incomplete specimen from Station XXIV, 16½ fathoms, ¾ mile N.W. of Pasco Reef (13.iii.29) has close agreement with Nutting's (1911, p. 28) species founded on specimens from Makassar (32 metres) and Aru Island (13 metres). It has no base of attachment, and may be only a part of a much larger specimen. There is a main branch about 150 mm. in length giving off, from one side only, six long secondary branches, of which one is 100 mm. in length. From these characters it is probable that the whole colony was a flabellum with very long terminal branches.

All the branches are slightly flattened and there is a well-defined groove running along the middle line of the flatter surfaces on both sides. The greater diameter of the main branch is 4 mm., and of the terminal branches about 2·5 mm. The verrucae are low mounds where the polyps are completely retracted, but scarcely visible where the polyps are fully expanded. The polyps are very small. The expanded anthocodiae have a body 1 mm. in length and 0·45 mm. in diameter. The tentacles are difficult to measure, but when fully expanded are about 0·65 in length.

The colour of the coenenchym is brownish red, approximately chestnut colour; the anthocodiae are quite colourless.

The spicules of the coenenchym are stout girdled spindles showing very little variation in size or form. They are approximately 0·15 mm. in length by 0·06 mm. in greatest breadth, including the tubercles. There are usually six whorls of tubercles on each spicule, but exceptionally eight whorls may be counted. A few spicules in a preparation are 0·18 mm. in length.

Their colour is orange-yellow by transmitted light, but decidedly pinkish by reflected light. The armature of the anthocodiae agrees so closely with that of the type that

Nutting's description may be quoted : " The entire dorsal surface of the infolded tentacles is covered with a complete armour of flattened longitudinal spicules or bar-like forms, there being numerous longitudinal series in each tentacle." All these spicules are quite colourless.

Gonads were not observed in this specimen.

A section of the axis shows a large number of spicules of the same size, form and colour as the spicules of the coenenchym embedded in a mass of colourless smooth branching fibres or rods. There is no central core, and no canals passing longitudinally through the substance of the axis.

When the axis is decalcified the girdled spindles have disappeared, and there is left a spongy mass of branching and anastomosing fibres. These fibres are about 0·03 mm. in diameter and do not differ in that respect from the fibres of the undecalcified axis, but they differ materially from them in appearance, having a much less sharp outline, and seem to be hollow tubes rather than solid fibres. In the undecalcified axis they are obviously very brittle, breaking into sharp angled blocks as the razor passes through them. For these reasons it seems certain that the horny substance of which they are composed is heavily calcified.

The axis agrees in general characters with the axis of *Sclerogorgia* described by Kölliker (1865, p. 144), and of *Suberogorgia appressa*, described by Kükenthal (1919, p. 685), but differs from them in the character that the girdled spindles in the axis are coloured. No mention is made by previous authors concerning the calcification of the horny matrix of the axis.

The type species of this genus is *Gorgonia suberosa*, Pallas, from the " Indian Ocean." Kölliker (1865) gave figures of the spicules of this species under the name *Sclerogorgia suberosa*, and a description of the axis of his new genus. Ridley correctly transferred the species to Gray's genus *Suberogorgia*. It was said to inhabit the coast of Africa and the Indian seas.

Studer (1878, p. 666) attributed a specimen from the N.W. coast of Australia, and Ridley (1884, p. 349) specimens from Torres Straits and Alert Island to this species. There is, however, no good description of the characters of the type, and there may be some doubt whether the W. Australian specimens are really identical with the type from the Indian seas.

If we can trust Kölliker's identification of the type-species, its spicules are of the same size and character as those of our specimen, but of a paler yellow colour, and the axis differs in so far as the included spicules are colourless. Nutting's species, *S. appressa*, is better known, and although it is difficult to distinguish it from the type-species by any very pronounced characters, it is probably, on the ground of distribution and on the general appearance, as shown in the illustrations in Nutting's Plate V as compared with Esper's Plate 49, a distinct species.

In Kükenthal's key plan of the species the difference between the two species is said to be that the branching of *S. suberosa* is dichotomous and of *S. appressa* lateral. A glance at the two illustrations of the types of these species referred to above shows that no distinction can be drawn between them in this respect. The terminal branching of *S. appressa* has exactly the same appearance of dichotomy as *S. suberosa*. Ridley's specimen of *S. suberosa* from Torres Straits, in the British Museum, has a pale orange-yellow colour and the terminal branches are relatively thicker than those of the specimen described above.

Family MELITODIDAE.

Melitodes ochracea, L.

Two specimens of this common and well-known species were obtained, one from Station 1 of the general survey of Low Isle (19.v.29), and the other from Penguin Channel, Station XII (24.ii.29). They are both irregularly fan-shaped in growth, and measure 100 mm. by 90 mm. and 180 mm. by 90 mm. respectively.

They exhibit the characteristic features of the species, a thick stem (13 mm. in diam.) with moderately thick secondary branches shading off into numerous very slender (1·5 mm.) terminal twigs. In the secondary branches the swollen nodes are almost spherical in shape (6 mm. in diameter), and the internodes, very variable in length, are 3 mm. in diameter. The maximum length of an internode is about 6 mm., but most of them are much shorter.

There are a few anastomoses in the middle and basal regions of the flabellum.

The only character by which the specimens do not fully agree with the definition of the species given by Kükenthal (1924, p. 62) is that the stem and main branches are almost cylindrical, not oval in section (abgeplattet). The verrucae are small (*ca.* 0·75 mm. in diameter), and in most of them the aperture is wide open, showing the infolded tentacles. They are very conspicuous owing to their bright orange colour.

Most of the verrucae are on one side of the flabellum, and on many of the branches they are arranged in two lateral rows, with a few scattered verrucae between them on a median bare track. On the opposite surface of the flabellum there are only a few scattered verrucae.

The colour of the coenenchym is a dark purplish-red. The nodes and internodes of the axis have the same colour. The anthocodiae are yellow.

The spicules of the coenenchym are spindles and clubs with coarse, blunt tubercles irregularly scattered over their surfaces, and between the typical spindle and the typical club there are many intermediate forms. The largest of these spicules are 0·12 mm., but the majority are only 0·1 mm. in length. The armature of the anthocodiae agrees with the description given by Kükenthal; the thin long yellow spicules of the crown that surrounds the base of the tentacles reach a length of 0·15 mm.

There were no gonads in either of them.

There can be little doubt that these specimens belong to the same species as the *Isis ochracea* of Linnaeus and the older writers. Kölliker (1872) described the spicules of the species under the name *Melithaea ochracea.* The generic name of the genus was changed to *Melitodes* by Verrill in 1864. Since that time many new species of the genus have been described.

M. ochracea was recorded from the Barrier Reef by Saville Kent. *M. esperi* from Torres Straits by Wright and Studer (1889, p. 179), and *M. albitincta* by Ridley (1884, p. 359) from Queensland.

There seems to be very little difference between *M. esperi* and *M. ochracea* except in the size of the spicules of the coenenchym. According to Wright and Studer, they are nearly twice as large (0·24 mm.) in *M. esperi* as they are in *M. ochracea.*

According to Kükenthal's key plan (1924, p. 55), *M. ochracea* differs from *M. squamosa* of Nutting from the Malay Archipelago in having flattened branches. The flattening of the branches of these Alcyonaria is probably caused by special external conditions of the locality in which they grow, and as a character has no value for the diagnosis of species.

In this case it is very striking how closely the specimens from the Barrier Reef agree with the description of the species by previous authors in all the principal characters except this one, and if the flattening of the branches is sound as a specific character, the new species it would be necessary to make for them would differ from *M. ochracea* in this character alone.

Kükenthal (1919, pt. 2, p. 150) considers that Nutting's (1911, p. 38) *Birotularia splendens* from the Kei Islands is identical with *M. ochracea*. The coenenchym spicules of this species are not only much smaller, but of quite a different type to any I have seen in *M. ochracea*, and, moreover, the characters of the ramification seem to be different in the two species. It may be a matter of opinion whether Nutting was justified in making a new genus for his species, but it certainly differs very distinctly from *Melitodes ochracea*.

Sub-Order HOLAXONIA.

Family Isididae.

Isis hippuris, L.

Two complete specimens and some fragments of this well-known and widely distributed species are in the collection :

One from Lizard Island, Reef A (3.vi.29), is 200 mm. high, the other from Three Isles (1–15.v.29) is 150 mm. high, and the fragments are from Low Isles A 2 (date ?).

The Three Isles are about 75 miles north of Low Isles and Lizard Island about 30 miles further north, in latitude 14° 40′ S.

The species is said to be common at the anchorage in Low Island (Stephenson, 1931, p. 82). Its very beautiful jointed axis and very thick coenenchym distinguish it at once from any other kind of Gorgonian on the Reef.

There is an excellent account of the history and anatomy of the species by Simpson (1909, p. 180), and, as my own observations on its structure agree very closely with his description, there is no need for me to describe those specimens in detail.

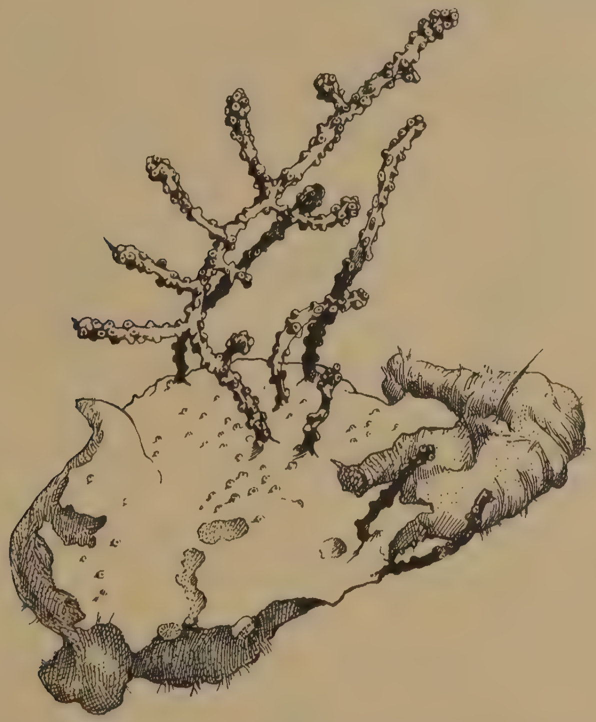
The specimen from Lizard Island collected in July bears numerous ova (0·45 mm. in diam.), which have the appearance of being nearly mature. The specimen from Three Isles collected in May is barren, and I found no gonads in the fragments from Low Island.

Family Plexauridae.

Euplexaura robusta, Kükenthal.

There are twelve specimens of this species from the Penguin Channel (8 from Station IX and 4 from Station XII). Of the specimens from Station IX, 6 consist of a single stem springing from a relatively small base of attachment; 2 consist of a wide base of attachment giving rise to several stems. The former range from 42–120 mm. high, and the branches, when present, are almost exactly in one plane. The smallest is unbranched; the largest has ten branches, some of which give off secondary twigs. There are no anastomoses. The branches in all the specimens are rather thick, the terminal ones being in many cases 3–4 mm. in diameter. Most of the branches have a knobbed extremity. In one specimen (102 mm. high) there are no verrucae on the base of attachment, nor on the proximal part of the stem, for a distance of 30 mm. from the base. On all the others the base bears a few small verrucae.

The other two specimens from this station are of special interest. One of them (D) consists of a large base spreading over a considerable area of an oyster shell (Text-fig. 1). It is irregularly circular in outline and about 40 mm. in diameter. On this base there are numerous irregularly scattered verrucae. It supports one branched stem (65 mm. high) and ten unbranched stems (2·5–40 mm. high). The other one (A) is also attached to an oyster shell and has a spreading base 30 mm. in diameter, which bears two stems about 15 mm. apart, one 30 mm. high, the other, which is bifurcated, 40 mm. high.



TEXT-FIG. 1.—*Euplexaura robusta.* Specimen D, showing a very large spreading base of attachment bearing verrucae. From the base arise one branched and several unbranched stems. Nat. size.

The four specimens from Station XII are 50–80 mm. high, and all bear branches, but in three of them the branching is decidedly not in one plane, but quite irregular and in all directions. In the fourth specimen (70 mm. high) the branching is as clearly in one plane as in the specimens from Station IX.

At first sight the verrucae seem to be smaller and rather wider apart than in the larger specimens from Station IX, but in these respects they do not differ from the smaller specimens from that station, nor from some of the branches of the larger specimen.

More detailed examinations of structure leave no doubt that the specimens from the two stations belong to the same species.

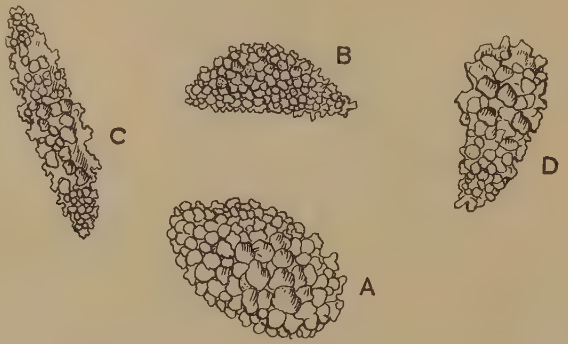
The verrucae are prominent dome-shaped structures, with eight triangular lobes, bent inwards at the upper end, and when fully grown are 1 mm. in diameter at the base and about 0·75 mm. in height. The whole surface of the verrucae, including the lobes, is heavily armed with spindle-shaped spicules.

In most of the specimens from both localities there are several smaller verrucae, with an aperture in the centre of the dome, which are not lobed as in the full-grown verrucae, and many forms of intermediate size with small lobes can be found.

The coenenchym between the verrucae is protected by a layer of close-set spicules, ovals, discs and other forms fitting close together to form a continuous shield.

The colour of all the specimens is a dull grey.

Spicules.—The outer layer of the coenenchym is armed with a continuous coat of thick discs or oval-shaped spicules, reaching a maximum size of 0·4 mm. in diameter and 0·45 × 0·2 mm. Many of these spicules are plano-convex in optical section, the outer convex surface having longer tubercles than the inner flat side (Text-fig. 2).



Text-fig. 2.—*Euplexaura robusta.* Four spicules of the coenenchym. A, Surface view of a disc. B, Side view of another disc. C, A typical spindle. D, An intermediate form. × 100 diam.

Beneath this layer the coenenchym is packed with thick spindle-shaped spicules, most of them about 0·2 mm. in length, but some much larger. They are not arranged in definite layers, but in a thick terminal branch there are four or five of these spindles between the axis and the outer layer. In many species of this genus the spindles have an equatorial band free from tubercles. I have not seen one of this type in my preparations.

The armature of the anthocodiae agrees exactly with the description and figures of the type by Kükenthal (1909, p. 18). There is a crown of two or three rows of bent spindles on which stand eight groups of three or four pairs of converging spicules to form the points. These spicules have the same size and form as those of the type.

Neither in the original description nor in the definition of the species in 'Das Thierreich' does Kükenthal refer to any further armature of the polyps.

In the description of *Euplexaura flabellata* from W. Australia, Broch (1916, p. 42) states that the tentacles are richly encrusted with small, feebly tuberculated rod-shaped spicules. This species was considered by Kükenthal to be identical with *E. robusta*, and Thomson and Dean (1931, p. 198), agreeing with this identification, refer to the well-armoured tentacles of their specimen from the coast of Ceram.

The tentacles of the specimens from the Penguin Channnel are densely pigmented, and it is difficult to clear them in oil, but dissections of the retracted anthocodiae have not revealed any trace of these small spicules in the tentacles.

The axis is brown and flexible in the terminal branches, but almost black in the main stem near the base. On treatment with acid the axis gives off a slow effervescence of very small bubbles, proving the presence of some calcareous deposit. In a main stem where the axis is 1·5 mm. in diameter, the central chambered core is 0·45 mm. in diameter, and the cortex about 0·5 mm. thick. The cortex is not loculated (gefächert), but solid throughout. At the proximal end of one of the branches, where the axis is 1·05 mm. in diameter, the core is 0·95 mm. in diameter and the cortex about 0·1 mm. thick. In this region the fibres composing the cortex are more loosely attached and small spaces between them are seen at the periphery.

A transverse section of a branch close to its origin shows that the polyps are connected with twelve large longitudinal canals running close to the axis. The polyps and the longitudinal canals are also connected with a network of smaller canals.

Female gonads 0·2 mm. in diameter were found in one of the specimens, and male gonads 0·2 mm. in diameter in two others. No gonads were observed in two, and six were not examined.

The species *E. robusta* was originally described by Kükenthal (1909, p. 18) from a specimen from Japan in the Vienna Museum.

According to the same author the species described as *E. flabellata* by Broch (1916, p. 42) from N.W. Australia belongs to this species. Thomson and Dean (1931, p. 198) record the species from the east coast of Ceram.

Although three other species of the genus have been described by Nutting from the Malay archipelago and four by various authors from N.W. Australia, *E. robusta* has not previously been recorded from the Barrier Reef or Torres Straits.

The species seems to be distinguished by the prominence of the verrucae, by the large disc-shaped spicules of the coenenchym, by the absence of double clubs or double spindles and its dull grey colour. In appearance it resembles *E. aruensis* (Kükth.), but the verrucae are not prominent in this species, double spindles occur in the coenenchym and the colour is brown ("hellbraun").

? *Euplexaura robusta*, Kükenthal.

There is a small specimen (x) from the Penguin Channel Station IX which is of some special interest, as it called my attention to the very close relationship of certain species of the Plexaurid genus *Euplexaura* and the Muriceid genus *Discogorgia*.

It consists of a stem 35 mm. high with a disc of attachment (*ca.* 7 mm. in diameter), and a long branch 45 mm. in length arising about 10 mm. from the base.

The diameter of the stem and branch is about 2 mm. The verrucae are scattered all round both stem and branch, are crowded above and separated by small spaces below. They seem to be rather smaller than in the other specimens of *E. robusta*, but the larger ones are almost 1 mm. in height and the same in breadth at the base.

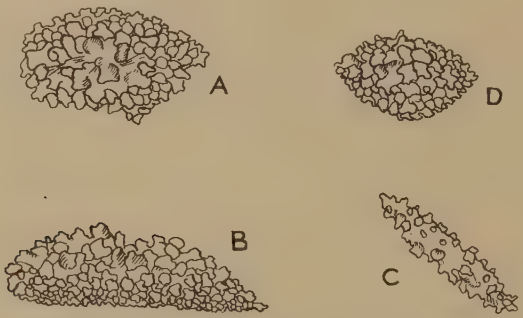
Nearly all of them are tightly contracted.

Examination of the surface shows that the verrucae are protected by overlapping spicules that are spindle-shaped above, and oval or disc-shaped at the base. The surface of the coenenchym is covered with disc-shaped or oval spicules, which also overlap in some places.

Spicules.—There are two distinct layers of the coenenchym—an outer layer bearing thick plano-convex discs or ovals, and an inner layer bearing nothing but spindle-shaped spicules. This inner layer comes to the surface at the top of the verrucae. The spicules agree very closely with those of the other specimens referred to this species.

The discs at the surface are from 0·2–0·25 mm. in diameter, and the larger ovals 0·3–0·45 mm. in length by 0·2 mm. in breadth. There is a complete range from discs, through ovals to thick blunt spindles (Text-fig. 3). The tubercles on the outer convex side of these spicules are longer and thicker than those on the flat side, and in character resemble those of the spicules of the *Placogorgia bebrycoides* of Nutting (1910 (A), pl. xxii, fig. 11).

The inner layer of the coenenchym is thin as compared with that of most of the other specimens in the collection referred to this species. There are not more than two spicules between the axis and the outer layer. These are spindle-shaped, pointed at the extremities, and have a maximum size of about 0·2 × 0·05 mm. The rough tubercles are densely crowded and are not arranged in whorls.



Text-fig. 3.—*Euplexaura robusta*. Specimen x (the "Discogorgia" form). Four spicules of the coenenchym. A, Surface view of a disc. B, Side view of another disc. C, A spindle. D, An intermediate form. × 100 diam.

The operculum in this specimen consists of a crown of two or three rings of spindles with low tubercles about 0·25 mm. in length, and eight points. In many of these points there are only two bent spindles meeting above, which, together with a spindle of the crown, form an acute angle triangle; but in others a third and sometimes a fourth spicule are interposed in the triangle.

Very small male gonads (0·15 mm. diameter) were observed in this specimen.

The colour is the same as that of the other specimens, and all the spicules are colourless.

The specimen agrees so closely with the description of *Placogorgia bebrycoides* by Nutting (1910*a*, p. 83) that at first I referred it to this species, but on further investigation I found that it cannot be separated from *Euplexaura robusta*. The genus *Placogorgia* was founded by Wright and Studer (1889, p. 113) for a species from 80 fathoms in the Atlantic Ocean. Nutting (1910*a*) added ten more species to this genus, but Kükenthal (1919, and 1924, p. 212) separated six of Nutting's species from the Malay Archipelago into a new genus *Discogorgia*, and thus *Placogorgia bebrycoides*, for example, became *D. bebrycoides*. Thomson and Dean accepted this transfer and gave a good figure of the species (1931, pl. xv, fig. 12), which, however, resembles very closely some of our smaller specimens of *Euplexaura robusta* (*cf.* also Kükenthal's figure, 1928, p. 95, fig. 67).

The specimen agrees in so many respects with the original description of *Euplexaura robusta* and with the other specimens of that species from the same locality in the collection that it must be referred to that species.

But it differs from the other specimens in two respects—the greater simplicity of the points of the operculum, and the more slender terminal branches due to a very thin coenenchym. In these respects it seems to agree better with *Discogorgia bebrycoides.* Nutting says that the most prominent feature of the operculum of that species is the three spicules forming an acute-angled triangle. This is, however, a variable character in *Euplexaura robusta.* I have examined a large number of verrucae of this species, and although the larger ones show points of the operculum with two or three pairs of spicules as shown in Kükenthal's figure (1909, p. 19, fig. 13), some of the smaller ones have only one pair, as in *Discogorgia bebrycoides.*

The slenderness of the branches gives the specimen described above a Muriceid appearance. In that respect it resembles Nutting's figure of *Discogorgia bebrycoides,* but as no measurements of the diameter of the terminal branches of this genus have been given, and no statement of the spiculation of the inner layer of coenenchym, it is difficult to determine whether this appearance is of essential importance.

But what are the differences between the Muriceid genus *Discogorgia* and the Plexaurid genus *Euplexaura* ? They agree in having a flabelliform ramification; the spicules of the outer layer of the coenenchym are almost identical in size and shape. They both have an operculum of the same type, and the verrucae are of approximately the same size and arrangement.

With these remarkable agreements, and in the absence of any knowledge of the characters of the coenenchym and axis of the type-species of *Discogorgia*, the only conclusion there can be is that this genus is identical with *Euplexaura.* The separation of the two genera in different families is only misleading, and leads to the establishment of many redundant species.

Family Muriceidae.

Muricella perramosa, Ridley.

One small specimen which seems to belong to this species was found on the Linden bank at a depth of 28 fathoms on 24th November, 1928. Linden Bank is off the line of the outer barrier reef about 25 miles E. of Low Isles. The specimen is perfect except that a part of the basal disc has been torn away.

It is 65 mm. high and the branching is almost in one plane, with a spread of about 55 mm. The main stem bears eight branches and some of these subdivide two or three times. The branching is not strictly dichotomous, although in some places it has the appearance of dichotomy. The main stem is 2 mm. and the terminal twigs 1 mm. in diameter. Most of the twigs terminate in swollen extremities about 1·5 mm. in diameter.

The verrucae are low mounds of a maximum height of 0·75 mm. They are not very crowded except on the terminal twigs, where they occur all round the axis without any definite arrangement. On the main stem most of the verrucae are lateral.

The colour is a dark purplish red.

Spicules.—The outer layer of the coenenchym is armed with large red straight or curved spindles. They vary so much that it is difficult to form an estimate of their average size, but many of them are 2·5 mm. in length by about 0·16 mm. in greatest thickness. Here and there larger spindles may be seen, the largest in my preparations being a little over 3 mm. in length (Text-fig. 5).

Below the surface the coenenchym is crowded with spindles of the same type, only much smaller.

The polyps are all contracted and the details of their armature are not easy to determine accurately, but there are certainly eight groups of flat, spindle-shaped spicules, which are much more definitely arranged " en chevron " than in *M. tenera*. The spicules of the coenenchym agree in form with those described by Ridley for the type. I have examined two preparations of the type spicules, and the largest I can find are only a trifle over 1 mm. in length. The colour of the spicules, also, is a pale orange red as compared with the dark purplish red of those of the Linden Bank specimen.

Although the spicules of our specimen differ from those of the type in these two respects, they agree with the spicules of the specimens of this species collected by the " Siboga " Expedition very closely both as regards size and colour.

The axis of this specimen seems to be purely horn: not the slightest effervescence occurred when a fragment was immersed in strong HCl. In the terminal twigs the axis has a very thin cortex and the core is divided in compartments by thin septa, of which there are about 26 to 1 mm. of length.

In the larger branches the cortex of the axis is much thicker and composed of longitudinal fibres. So far as I could judge from one observation, it is not loculated.

The specimen is a male with gonads 0·2–0·3 mm. in diameter.

The type-specimen of this species described by Ridley (1882, p. 128) is in the British Museum (registered number 82.4.6.1). " It has a broad, fan-like outline," and is 500 mm. high by 175 mm. in extreme breadth. It was found in 90 fathoms of water off the coast of Mauritius.

I have examined spicule preparations and the terminal twigs of the type-specimen, and find that the largest of the spindles of the coenenchym is about 1 × 0·16 mm., in close agreement with Ridley's figures, but the statement that the diameter of the main branches is about 0·18 mm. and of the terminal twigs 0·018 mm. is quite erroneous. The diameter of the main branches of the type-specimen is roughly 5 mm., and of the terminal twigs 1 mm.

The specimen attributed to this species by Wright and Studer (1889, p. 126) was found off Japan in 345 fathoms of water. The largest spindles of this specimen were 1·7 × 0·145 mm.

Nutting's specimens were found in the Kei Archipelago, off New Guinea and other localities in 32–90 metres of water, and the largest spindles are 2·5 mm. in length.

If it be assumed that the identifications of these authors are correct, it is evident that this species has a wide geographical distribution, and a range in depth from 30 metres to 345 fathoms.

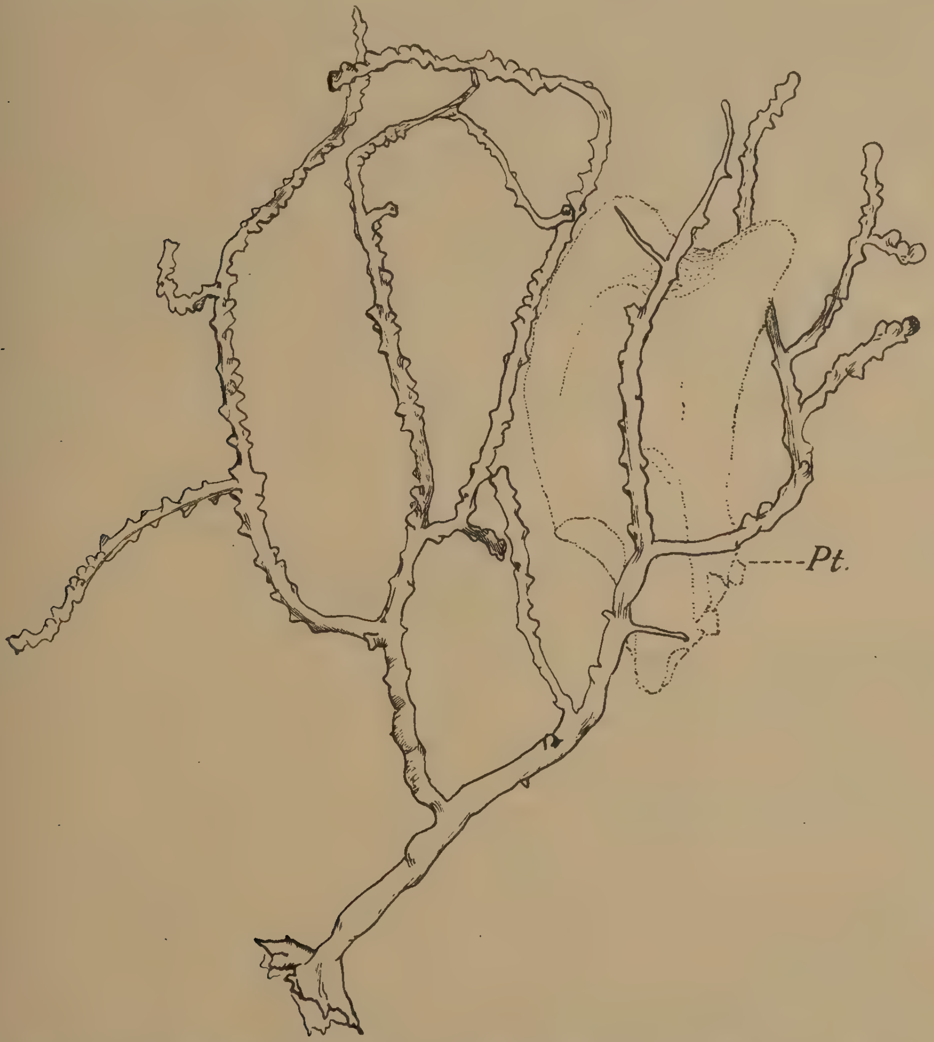
There seems no reason to doubt the validity of these identifications. The only prominent character in which they differ is in the size of the largest spindles of the cortex.

Muricella tenera, Ridley.

There are eight specimens in the collection which may be referred to this species. They were all dredged in the Penguin Channel, five at Station IX (Q) and three at Station XII (E and G).

Every specimen has been carefully examined, and notwithstanding certain differences in minor variable characters I am convinced that they all belong to the same species.

They afford a very interesting study in the variation of ramification and, as some specimens are less contracted than others, the variation in the size and form of the verrucae in the several phases of the contraction of the polyps.



Text-fig. 4.—*Muricella tenera.* Specimen G. A *Pteria marmorata* is attached to a branch of the colony (*Pt.*), and has modified the growth and number of verrucae. Nat. size.

The largest specimen (G) has the general form of a half flabellum (Text-fig. 4). Two branches arise on one side only of the main stem; the lower one subdivides into a number of secondary branches, the upper one is undivided. Above these branches the main stem appears to bifurcate, but both divisions bend over towards the same side as the lower branches. Attached to the colony at the point of bifurcation there is a bivalve (*Pteria marmorata*) 60 × 30 mm. in size, which may have influenced the growth from this point upwards.

This specimen is unfortunately very tightly contracted.

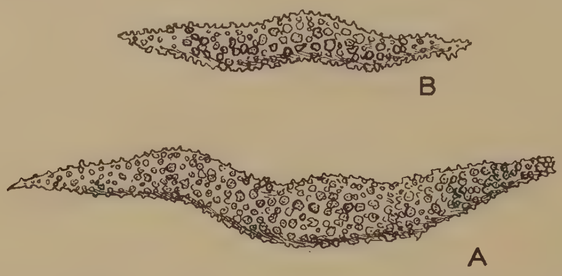
The colony is 130 mm. high and about 80 mm. broad. The disc of attachment is 15 mm. in diameter.

The main stem, consisting of the axis and a very thin covering of coenenchym, is 4 mm. in diameter.

The diameter of a branch taken about the middle of its course is 2·5 mm. and the coenenchym is relatively thick. The terminal branches are up to 60 mm. in length; some have swollen extremities and some have not.

There are no verrucae on the main stem. On the branches they are irregularly distributed, with a tendency in some places to a bilateral arrangement, in others to a spiral arrangement.

In this contracted specimen the verrucae are pointed cones with the aperture closed. They have an average height of about 0·5 mm., none of them exceeding 1·0 mm. high. In some places they are crowded together, in others 2–5 mm. apart. On the stem the very thin coenenchym has only one layer of spicules. In a branch 0·9 mm. in diameter there is an outer layer of large spicules and an inner layer of smaller ones.



Text-fig. 5.—The largest spicule in a group of several hundred taken from the coenenchym of each of the species A, *Muricella perramosa* and B, *Muricella tenera* to indicate their relative sizes. × 35 diam.

The colour of all the specimens of this species is a dirty grey.

The spicules of the coenenchym are all spindles with a maximum size of about 1·5 × 0·15 mm. (Text-fig. 5). Some are slightly bent. They are covered with numerous small tubercles, which are not arranged in definite lines or girdles, nor are the tubercles in any spicules appreciably longer on one side than on the other, as they are in so many Muriceidae.

Some of the spicules of the verrucae are a little larger than those of the coenenchym, and most of them extend up from the base to the apex of the cones, but in many of the verrucae smaller spindles are inserted between the larger ones towards the apex.

The arrangement of the spicules of the anthocodiae cannot be easily determined in this contracted specimen, but so far as I can judge from dissections it does not differ from that in specimen Q1, which is described later.

The specimens from Station IX (Q) are not so tightly contracted, and in many cases a part of the body-wall of the anthocodiae and the tentacles protrude from the aperture of the verruca. They are respectively 140, 80, 80, 75 and 60 mm. high. Each one has a small base of attachment and is apparently perfect.

The largest one has five branches arising in one plane right and left of the main stem at irregular intervals. Another specimen has four branches, which are not in the same plane. The others have only two or three branches which are in the same plane.

The verrucae vary considerably in size. In one specimen they are 2–2·5 mm. high on some of the branches and densely crowded together. On other branches of the same colony they are much smaller and separated by intervals of 2–5 mm. The aperture of many of the verrucae is wide open, showing clearly a well-defined operculum protecting the anthocodiae. The spicules of the verrucae in these cases do not converge as in the contracted ones, but stand up at right angles to the coenenchym, forming a paling round the anthocodia. The spicules of the true calix, forming, in the contracted condition, the operculum, consist of eight triangular groups of spindles ("points"), surrounded by a ring ("crown") of similar spicules. This ring is rarely composed of more than one spicule in thickness, and in some cases consists of only one or two transversely placed spicules altogether.

The spicules of the "points" are very variable in size, but rarely exceed 0·45 mm. in length; the spicules of the "crown" are larger, and in some cases 0·9 mm. in length. They can be distinguished from the coenenchym spicules by their smaller tubercles, but in this respect, as in size, the "crown" spicules are intermediate between those of the operculum and those of the coenenchym.

There are no spicules in the upper part of the body-wall of the anthocodiae, nor in the tentacles.

Two specimens from Station XII (E and E^1) are about 85 mm. high. One of them (E) has a small base of attachment and is apparently perfect. In the other the proximal end of the main stem is broken and covered by an encrusting sponge. It bears three lateral branches, which are apparently quite healthy.

As the verrucae of both specimens are partially expanded, the structure of the operculum as well as other characters can be easily examined, and there can be no doubt that the two specimens belong to the same species. But the differences in external appearances between them are very striking.

In E the branches arise in one plane right and left of the main stem, the verrucae are closely crowded together on the terminal branches, and the larger ones are 1·25 mm. high. The terminal branches are 2 mm. in diameter.

In E^1 the branches are not in one plane; the verrucae even on the terminal branches are situated at intervals of 2·0 mm. or more apart, and are very much smaller than the verrucae of E, the largest being only 1 mm. high. The terminal branches are 1 mm. in diameter.

All the specimens of this species in which gonads were observed were males. Specimen G from Station XII was apparently barren, but specimen E from the same station bore testes from 0·1–0·2 mm. in diameter, and specimen E^1 testes up to 0·45 mm. in diameter. The specimens from Station IX were with one exception males with testes 0·08–0·1 mm. in diameter.

The variations observed in this species may be summarized as follows:

The ramification is usually in one plane, but in two small specimens (*ca.* 85 mm. high) it is not in one plane.

There are great variations in the thickness of the coenenchym. In one specimen, E, the terminal branches between the verrucae are twice as thick as they are in another specimen from the same locality.

The verrucae vary in size according to the state of contraction. In a large contracted specimen they do not exceed 1 mm. high; in a smaller partially expanded specimen they are 2–2·5 mm. high, but they also vary independently in size, as seen in specimens E and E^1.

There is also great variation in the degree of crowding or dispersal of the verrucae.

The characters in which there is agreement are:

1. The ramification of the larger forms is in one plane.
2. The spicules of the coenenchym are spindles provided with numerous scattered tubercles which do not exceed a maximum length of 1·0–1·5 mm. (Hiles, 1899, p. 50, referred a specimen from Funafuti to this species with spicules over 4 mm. in length).
3. There is a well-developed operculum, consisting of eight triangular points and a crown of single spicules.
4. The colour is dull grey and all the spicules are colourless.

The type of this species is in the British Museum. It is a small specimen, and was named *Muricella tenera* by Ridley (1884, p. 335). It was dredged in 14–20 fathoms of water off Port Molle on the coast of Queensland.

A large specimen of the same genus (300 mm. high) found in 49 fathoms in the neighbouring Arafura sea was referred to the new species *M. crassa* by Wright and Studer (1889, p. 131).

Some of the specimens in this collection are intermediate in size between the types of these two species, and as their characters are, in some respects, intermediate between them they link the two species together.

An examination of the type of *M. tenera* shows that they cannot be satisfactorily distinguished from that species, but they afford some evidence that *M. tenera* is identical with *M. crassa*.

The two species agree in having a flabellate form of growth, in colour and in the general form, size and detailed structure of the spicules. The differences are that in *M. tenera* the coenenchym is said to be thin and in *M. crassa* very thick. According to Ridley the spicules of the verrucae are either 1·5 mm. or 0·9 mm. in length in *M. tenera*, and according to Wright and Studer the spicules of the "calix" of *M. crassa* are 0·9 mm. in length.

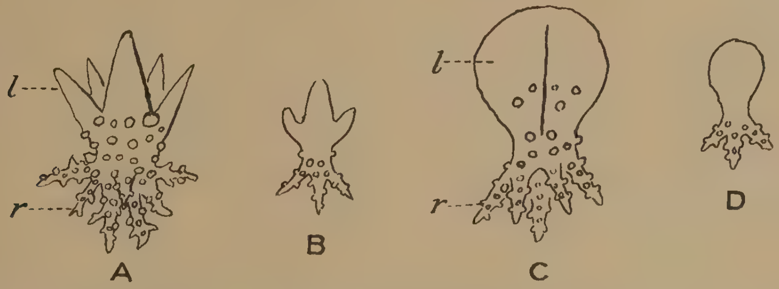
The vague statement that the coenenchym is very thick in *M. crassa* does not help in the determination of the species. In most of our specimens the coenenchym is very thin on the main stem and the proximal end of the primary branches, becoming gradually thicker towards the terminal ends, where it is relatively very thick. At a distance of about 20 mm. from the distal end in one specimen the axis is 0·9 mm. in diameter and the coenenchym 0·3 mm. in thickness. The difference in size of the coenenchym spicules is not material. The largest spicules in the specimens in the collections are pretty uniformly 1·2 mm.; in the fragment of the type-specimen of *M. tenera* that I examined there are none over 1 mm. in length. It is not quite clear what Wright and Studer meant by the "calix" in their account of *M. crassa*. It is probably not the same thing as the "verruca" of Ridley, but the group of spicules at the base of the anthocodia forming the true calix or operculum. Ridley gives the size of the spicules of the "polype" of *M. tenera* as about 0·35 mm. in length, but there is no good account of the constitution of the operculum in this species.

In our specimens the spicules of the triangular groups ("points") of the operculum are very variable in size and rarely exceed 0·4 mm. in length. The spicules of the surrounding ring "crown" are larger, and in some cases are 0·9 mm. in length.

The identity of *M. crassa* and *M. tenera*, however, cannot be firmly established, as the type-specimen of the former was not returned to the British Museum with the rest of the "Challenger" Collection, and it is not known where it has been deposited.

Genus *Echinogorgia*, Kölliker.

This genus was founded by Kölliker in 1865 (p. 136) for certain species formerly referred to *Gorgonia* by Esper. His definition of the genus simply stated that the species has a horny axis with small superficial spiny spicules of a peculiar form, and small or slightly developed calices. These peculiar spicules received different names. The forms with a single flat leaf as in *E. sasappo* he called "Schuppenkeulen"; the forms with triangular leaves, as in *E. furfuracea*, he called "Stachelkeulen" (Text-fig. 6). The name "Blattkeulen" in this paper was confined to the spicules of certain species of *Eunicea*.



TEXT-FIG. 6.—Diagrams to illustrate the structure of the Blattkeulen. A, The variety called "Stachelkeule" by Kölliker. B, Small form of the same variety. C, The variety called "Schuppenkeule" by Kölliker. D, Small form of the same variety. *l*, the leaves; *r*, the roots. In C the single leaf has a median keel and bears some tubercles.

Kükenthal (1919, p. 5) defined the "Blattkeulen" thus: "Die Stacheln der Anschwellung verbreitern sich blattförmig; bei plattenartiger Ausbreitung einzelner Blätter entstehen sie Schuppenkeulen."

In recent times the term "Blattkeulen" has been used in a more general way for the spicules belonging to several genera in which leaf-like processes project from the surface of the coenenchym and verrucae, and are supported by root-like processes which penetrate into the mesogloea. Kükenthal himself, in 1924, calls the spicules of *Echinogorgia sasappo* and *Plexauroides praelonga* "Blattkeulen," which, according to Kölliker's definition, are typical "Schuppenkeulen."

Several authors writing in the English language have called these spicules "foliaceous clubs." In my opinion it is better to retain Kölliker's original name "Blattkeulen," but to use it in a more general sense.

In many of the species of the genus large tuberculated spindles are also found, usually situated in the coenenchym close to the axis. In *E. sphaerophora* some of these spicules occur at the surface and can be seen without dissection in dry or preserved specimens. They vary from 0·5–1·0 mm. or more in length. In *E. furfuracea* there are no spindles as large as this.

In some species a few large spicules may be found which seem to be a combination of these two types, *i. e.* a spindle- or half-spindle-shaped base with foliaceous expansions at one end or on one side. Such a spicule is figured by Kölliker (1865, pl. xviii, fig. 9, 1) for *E. sasappo* and is termed a " halbseitige Blattkeule " (Text-fig. 8). These spicules, which may be formed by a fusion of two or more scleroblasts in development, are not common in any of my preparations, and in some cases I have found only one on searching through a heap of several hundred dried spicules.

It would not be wise to use the presence or absence of these spicules as a guide for the determination of species.

A third type of spicule is very common in preparations of the spicules of the species of this genus. It consists of a short, smooth, median bar, terminating in a knob at each end. They are always very much smaller than spicules of the other two types. They have received various names according to the size and arrangement of the tubercles on the knobs; *e. g.* dumbbells, capstans, double wheels, double stars, etc. (Text-fig. 10).

Woodland (1905, p. 300) described a form of this type in the development of the spicule of *Alcyonium* under the name " caudal vertebra."

In this report I have used Sir Arthur Thomson's word " capstans " throughout for spicules of this type.

There can be little doubt that these spicules in this genus are stages in the development of spicules of the other types. It may be that in some cases they are arrested in development and never get beyond the " capstan " stage, but there is no evidence to prove or to disprove it.

The relative number of these spicules in preparations is not constant. In the case of two species (*E. furfuracea* and *E. reticulata*) I found a great many more " capstans " in the larger specimen than in the smaller one. In the species referred to *Plexauroides* I found no " capstans " in my first preparations, but on searching through a heap of dried spicules a few typical capstans in three out of six specimens.

The only conclusion that can be drawn from these observations is that the presence or absence of "capstans" cannot be safely used for the determination of specific characters.

The method adopted in this report for the determination of the species of this genus is to take Esper's description and figures of the species referred by Kölliker to the genus *Echinogorgia*, and the figures given by Kölliker of the spicules of the original types in the Erlanger Museum, which he investigated. The specimens in the collection which agreed in ramification and colour with Esper's plates and in the general character of the spicules with Kölliker's figures were referred to Esper's species. In this way four out of the five species were identified. One species (*E. sphaerophora*) was quite distinct from the others in having large spindle-shaped spicules at the surface of the coenenchym, and this has been referred with some hesitation, as the only specimen is a very small one, to the species proposed by Kükenthal.

Of the five species in the collection, *E. sasappo* is distinguished from the others by having " Blattkeulen " of the variety known as " Schuppenkeulen." The others have typical Blattkeulen. *E. sphaerophora* is distinguished from the others by having large spindles at the surface of the coenenchym.

E. furfuracea and *E. reticulata* have, when full grown, profuse ramification in one plane with anastomosing branches.

E. furfuracea has colourless spicules and no large spindle-shaped spicules in the coenenchym.

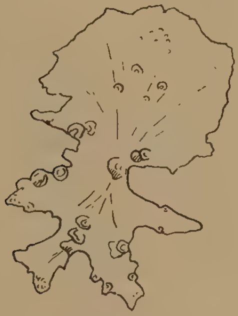
E. reticulata has red spicules and many large spindles in the coenenchym.

E. umbratica has a loose flabelliform ramification without anastomoses and colourless spicules.

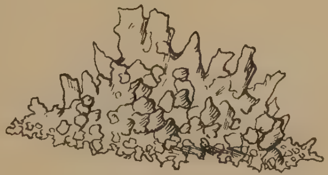
Echinogorgia sasappo, Esper.

There are two specimens dredged in Penguin Channel (Station XII).

The larger of these (specimen L) consists of a main stem, without a base of attachment, 100 mm. high. From this stem spring three branches, not in the same plane, at intervals of about 30 mm. The longest of these branches is 25 mm. The stem and branches are about 2·5 mm. in diameter.



TEXT-FIG. 7.



TEXT-FIG. 8.

TEXT-FIG. 7.—*Echinogorgia sasappo.* One of the larger Blattkeulen without a keel on the leaf.
TEXT-FIG. 8.—*Echinogorgia sasappo.* One of the spicules called "halbseitige Blattkeulen" by Kölliker.

The verrucae are prominent, some dome-shaped, others, more fully expanded, conical. The height of the conical verrucae is 0·75 mm. They are densely crowded on all sides of the stem and branches, but are smaller and more scattered on the lower third of the stem.

The colour is salmon-red.

SPICULES.—The surface of the coenenchym and verrucae is protected by a layer of "Blattkeulen" of the variety "Schuppenkeulen," the leaves of which project irregularly on the coenenchym, but overlap like imbricated scales on the verrucae. These spicules are extremely variegated in form and size, but the maximum size appears to be about 0·3 mm. in length.

The smaller forms, 0·18 mm. in length, consist of a single smooth leaf and three tuberculated rootlets (Text-fig. 6, D).

In the largest forms there is a single leaf with a crenated edge and a single keel, or in addition to the keel two or four lateral ridges, in which case the keel and ridges project from the edge of the leaf, giving it a palmate outline; and in the more complicated forms the keel and ridges are expanded vertically to form secondary plates at right angles to the leaf. There are some "Blattkeulen," however, without keels on the plates (Text-fig. 7).

All the Blattkeulen are pale pink in colour.

There are no spindle-shaped spicules at the surface of the coenenchym, but lying close to the axis and parallel with it there are some large profusely tuberculated spindles reaching a size of 0·75 mm. × 0·15 mm. In addition to the typical spindles there is a great variety of irregular shaped spicules, bearing, in many cases, triangular tubercles on one side only. The largest of these are of the type called by Kölliker " halbseitige Blattkeulen " (Text-fig. 8). Most of these spicules are colourless, but a few have a faint pink colour.

There are some pink capstans in my preparations 0·1 mm. in length.

A few of the polyps of this specimen are partially expanded. There is a thick collar of spicules below the tentacles, composed of straight or slightly bent spindles with small pointed tubercles, and a few forked spicules. The largest spindles in one of these anthocodiae are about 0·2 × 0·03 mm., but there are longer spindles of this type in the spicule preparations. There are no spicules in the tentacles nor, apparently, at the base of the anthocodia.

There is some calcareous matter in the axis.

The specimen is a male with gonads 0·3 mm. in diameter.

The smaller specimen (Dd) consists of a stem 55 mm. high, attached to a worm tube by a small circular disc 7 mm. in diameter. A small broken branch arises at right angles to the stem 38 mm. from the base. The diameter of the stem is 1·5 mm.

The characters of the verrucae and the colour agree with those of the larger specimen.

SPICULES.—The " Blattkeulen " which cover the surface of the verrucae and coenenchym differ from those of the larger specimen in a more general simplicity of form. The smaller ones, 0·2 mm. in length, have a single smooth leaf with two or three rootlets. The larger ones have two or three tubercles on the upper side of the leaf, but no keel; the largest, 0·3 mm. in length, occasionally show a median keel, but never lateral ridges, and in only a few forms is the leaf lobed or divided.

There are some pink tuberculated spindles in the coenenchym, of which the largest I have measured is 0·5 × 0·16 mm.

There are some capstans (0·1 mm.), and numerous small (0·1–0·2 mm.), very irregular spicules, crosses, rods, etc., which may be younger stages of the other types.

From the examination of two partially expanded polyps it seems certain that the spiculation of the anthocodiae is similar to that of the larger specimen.

The specimen is a male, with gonads 0·3 mm. in diameter.

The differences observed between the spicules of these two specimens might be regarded as of sufficient importance to separate them into two distinct species.

I am convinced, however, that these differences are correlated with the size or age of the two specimens. In both specimens numerous small " Blattkeulen " (about 0·18 mm.) can be found which are identical in shape; between these and the elaborate " Blattkeulen," with 3- or 5-fid leaves armed with prominent keels, there are many intermediate stages in both specimens, but in specimen L the later stages are dominant, in specimen Dd the earlier stages are dominant.

The spindles of the cortex, which are mainly colourless in L, but coloured in Dd, offer another point of difference which may be correlated with the size of the branches. These spicules are found only in the lower layer of the cortex, and if the development of the colour is determined by light, the specimen with the thinner cortex and less elaborate

"Blattkeulen," which would be more penetrable by light, would be more likely to have coloured spindles.

The illustration of *Gorgonia sasappo* given by Esper (1797, pl. ix) shows a number of red gorgonians, each with a few branches as in our larger specimen. The coenenchym is rather thick, and the low verrucae are densely crowded all round the branches.

Kölliker (1865, pl. xviii, fig. 9) gives three figures of the spicules of *Echinogorgia sasappo*; one of these (No. 3) with a single leaf and a complex root is similar to many spicules of the larger specimen L, but does not show the prominent keels which most of the "Blattkeulen" of this specimen possess. I have found a few spicules in my preparations corresponding with Kölliker's (No. 1) of a "halbseitige Blattkeule" and there are several spicules in the smaller specimen similar to his (No. 2) of a "Warzenkeule."

The spicules of *E. mertoni* (Kükenthal, 1919, p. 282) are similar to those of our smaller specimen, but the colour of this species is grey.

The species described by Nutting (1910, p. 66) as *E. flora* agrees with our specimens in the lax ramification, and the only type of "Blattkeule" that is shown in his pl. xxi, fig. 10, is similar to many that occur in my preparations. The colour of *E. flora*, however, is "very light brown and the spicules colourless." This species, however, is also closely related to *Plexauroides praelonga* (see p. 498, *infra*).

The name *Gorgonia sasappo* was given by Pallas to a species which he identified with the Accarbaar Sasappo of Rumphius ('Herbarium Amboinense,' vol. vi, p. 223, t. 83). A comparison of the figure given by Rumphius with the figure given by Esper of *Gorgonia sasappo* suggests very strongly that the gorgonian called by the Malays Accarbaar Sasappo is not identical with Esper's species.

However, if the specific name stands, as it should do, it should be spelt as Rumphius spelt it, and not in the form sassapo, as used by Kükenthal and other writers.

Echinogorgia furfuracea, Esper.

There is one large specimen (B) belonging to this species and a small one (P) which may be a juvenile form of the same species. They were both dredged in the Penguin Channel, the former at Station XII and the latter at Station IX.

The larger specimen (B) is definitely flabellate in form and the branches anastomose in several places. The frond, as it is preserved—the base is missing—is 200 mm. high and 150 mm. broad—the largest specimen in the collection.

The stem divides close to its origin and is lost in the general ramification. There is no pronounced midrib.

The main branches are almost uniformly 3 mm. in diameter. The terminal branches are very short and slightly swollen at the extremity.

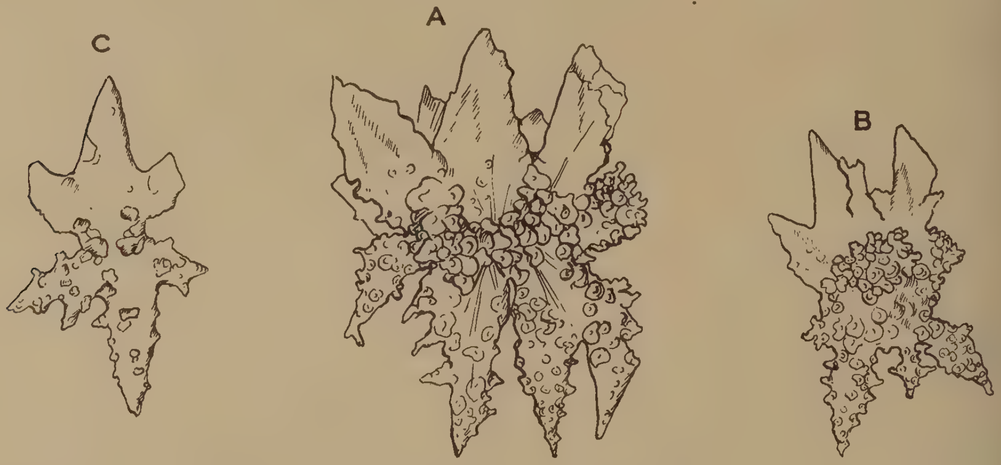
The verrucae are low mounds about 1 mm. in diameter at the base. They are irregularly distributed, and rather crowded on the terminal and secondary branches.

The colour of the specimen in spirit is dark grey, almost black on the older branches, but there is a note on the label—"yellow in colour."

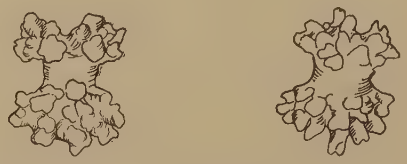
SPICULES.—The "Blattkeulen" cover the coenenchym and verrucae. When full grown they are a little over 0·3 mm. in length and 0·3 mm. in breadth. They exhibit three to eight or more triangular leaves and have three to four tuberculate roots

(Text-fig. 9). The arrangement of the leaves is very variable. In some cases they have a roughly radial arrangement; in others the outer leaves are arranged in an irregular circle round a group of three or four central leaves. In many others there is a very prominent central leaf with an irregular group of smaller leaves around it.

The leaves are usually smooth and triangular in section, but some of them bear a few scattered tubercles. The smallest "Blattkeulen," 0·2 mm. in length, have three pointed leaves in a row and usually three short roots (Text-fig. 9, C).



Text-fig. 9.—*Echinogorgia furfuracea.* A and B, Two forms of the larger Blattkeulen. × 200 diam. C, A smaller form. × 300 diam.



Text-fig. 10.—*Echinogorgia furfuracea.* Two examples of the "capstan" spicules. × 300 diam.

There are numerous small "capstans" and stellate spicules (*ca.* 0·06 mm. in length) in the coenenchym (Text-fig. 10).

An important feature in the spiculation of this specimen is the absence of any very large spindle-shaped spicules in the coenenchym. A few straight tuberculated spindles occur in the older branches, but the largest of these is not more than 0·3 mm. in length.

The polyps are so tightly contracted in the specimen that the spiculation of the anthocodiae cannot be very satisfactorily determined, but the spicules which form the operculum have the usual form of slender straight or bent spindles with low tubercles and about 0·3 mm. in maximum length.

All the spicules are quite colourless.

The axis at the base is 3 mm. in diameter, and consists of an excentric core about 0·2 mm. in diameter, bearing crowded crystals of calcium carbonate, and a very thick dense cortex without a trace of loculi.

The axis of the terminal branches is similar to that of the other species, with its chambered core and a cortex of loosely bound horny fibres.

The specimen is male, with gonads 0·2 mm. in maximum diameter.

The small specimen, P, is 50 mm. high × 30 mm. broad. It is flabellate in form, and divides into twelve terminal branches without anastomoses. It springs from a disc-shaped base of attachment about 8 mm. in diameter.

The verrucae are a little smaller than in the larger specimen, but in form and distribution they agree with the verrucae of the larger specimen.

The colour is dark grey.

SPICULES.—The "Blattkeulen" are similar to those of B, but smaller and simpler in form. The largest in my preparation is 0·24 mm. in length and has four leaves and three roots.

The smaller forms have three leaves in a row and three roots.

There are a few small capstans and, in my preparation, one tuberculated spindle 0·4 × 0·07 mm.

No gonads were observed in this specimen.

The illustration given by Esper (1797, pl. xli) of *Gorgonia furfuracea* agrees very closely in form and colour with the larger specimen (B) in this collection.

The spicules figured by Kölliker (1865, pl. xviii, fig. 18) are similar to many of the spicules in my preparations, although the "Blattkeulen" as drawn by him are smaller (0·2 mm.).

Kükenthal (1924, p. 201) says that in this species the walls of the verrucae bear peculiar "Blattkeulen," in which the leaves form a collar round a narrow central space.

There are no spicules answering to this description in the verrucae of either of our specimens, and there is no such spicule in Kölliker's illustration of Esper's type-specimen.

Kükenthal's description of the species was based on an investigation of the specimen referred to this species by Studer (1878, p. 652) from W. Australia.

Nutting (1910*a*, p. 63) described a specimen from the Flores Sea under the name *E. furfuracea* with "Blattkeulen" on the verrucae, bearing leaves similar in arrangement to that described by Kükenthal and others, in which the leaves are heavily keeled. In Kölliker's drawings of the type the leaves of the "Blattkeulen" are not keeled. The "Siboga" specimen also differs from the type in colour, being light pinkish brown.

The specimens described as *Echinogorgia furfuracea* by Studer and Nutting seem to differ in some important respects from the two specimens described under the same name in this paper and from Esper's type-specimen.

There can be no doubt that the specimens described by Ridley (1884, p. 337) from Port Denison and Port Curtis on the coast of Queensland as *Echinogorgia flabellum* belong to the same species as those referred in this report to the species *E. furfuracea.* I have examined the specimens* and preparations of their spicules in the British Museum, and find them in almost complete agreement with the specimens from the Penguin Channel.

There is no evidence, however, that Esper's *Antipathes flabellum* was an *Echinogorgia.* Only the bare axis is shown in the illustration, and this is more suggestive of a *Plexaurid* than of a Muriceid. Kölliker does not give any notes on this type. The species should therefore disappear from our lists and Ridley's specimens referred to *E. furfuracea.*

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* There are two or three specimens on the sheet with the same name, which may not belong to this species. The specimens referred to here are registered as follows: 81.10.21.165 and 177.

Echinogorgia sphaerophora, Kükenthal.

There is a very small specimen in the collection from the Penguin Channel (Station IX) which, with some hesitation, may be referred to this species.

It consists of a single stem 55 mm. high, with two short branches and a rudimentary one, attached to a stone by a circular disc of attachment 5 mm. in diameter. The stem and branches are not more than 1 mm. in diameter.

The verrucae are crowded on all sides, rather prominent and almost hemispherical in shape.

The colour is pale red.

SPICULES.—The " Blattkeulen " are very irregular in form, but, as in the type-specimen, they are smaller (0·2 mm.) than in most of the species of the genus.

In many there is a single trifid leaf, in some cases with a definite keel, in others densely tuberculated at the base. In other " Blattkeulen " there are several pointed leaves quite irregularly arranged. They bear three or four thick, short, and densely tuberculated rootlets. The smallest " Blattkeulen " have three pointed leaves in a row and three or four short thick tuberculated roots.

These spicules are all colourless.

The most characteristic feature of the species, however, is the presence of large spindle-shaped spicules at the surface of the coenenchym. They are pink in colour and from 0·6 to 0·9 mm. in length.

The larger ones are plano-convex in optical section and are densely covered with large tubercles, those on the outer convex surface being the most prominent.

There are a few small " capstans," but owing to the very small size of the specimen only one preparation of spicules has been examined.

The verrucae are fortunately not very tightly contracted, and the operculum can be clearly seen. It agrees very closely with Kükenthal's description and figure of the type-specimen (1919, p. 287).

Gonads were not observed in this specimen.

The original description by Kükenthal (1919, p. 286) of this species was based on the examination of two specimens in the Münich Museum with the rather vague locality " Ostindien." The two specimens were respectively 195 mm. and 87 mm. high, and therefore much larger than the specimen from the Penguin Channel.

The smaller of the two original specimens differs in some respects from the larger one, and Kükenthal had some hesitation in placing it in the same species.

Both specimens, however, form fan-shaped colonies, with some anastomoses of the branches and a similar armature of the polyps.

The large spindle-shaped spicules of the cortex are, however, very much larger (0·5 mm.) in the smaller specimen than in the larger. In the very small Penguin Channel specimen they are apparently larger still (0·9 mm.). Neither of the type-specimens had a red colour; they were both " hellgrau."

The very large spindle-shaped spicules call to mind the large spicules of *E. macrospiculata* (Thomson and Simpson, 1909, p. 219), but in this species they are not stated to be at the surface of the coenenchym as in *E. sphaerophora*, and in other respects the two species are not in agreement.

Echinogorgia reticulata, Esper.

There are two specimens in the collection from the Penguin Channel belonging to this species, one (H) from Station XII and the other (F) from Station IX.

Specimen H consists of a main stem arising from a spreading base of attachment 20 mm. in diameter, giving off branches sparsely in approximately the same plane to form a loose flabellum. It is 100 mm. high × 70 mm. broad. There are no anastomoses.

The branches are comparatively slender—*ca.* 2 mm. in diameter. The main stem at the base is 3 mm. in diameter.

The verrucae are rather more prominent than in the specimens of *E. furfuracea*, densely crowded and without any definite arrangement.

The colour of the colony is a dark purplish red.

Spicules.—The larger " Blattkeulen " are about 0·36 mm. in length × 0·3 mm. in breadth. Their leaves are triangular in shape and the root bears three or four pronounced rootlets. At the margin of the calix the " Blattkeulen " usually bear five pointed leaves in a row, the middle leaf being very prominent.

The leaves of these spicules in the coenenchym bear numerous blunt tubercles and in others the margin is dentated.

There seems to be no definite arrangement of the leaves. In many there is a prominent leaf in the centre, surrounded by a circlet of smaller leaves, but in the large ones there is no regular arrangement. Some of the larger spicules have a blunt, tuberculated keel.

All these spicules are pink in colour.

There are very few capstans in this specimen. They have a very faint pink colour.

There are numerous profusely tuberculated pink spindles in the coenenchym, varying in size to a maximum of 0·9 × 0·13 mm., but none of these are visible at the surface.

The spicules of the anthocodiae are bent spindles, *ca.* 0·3 mm. in length, with a maximum thickness of 0·03 mm. They are thicker than the corresponding spicules of *E. furfuracea*. In the retracted verrucae they form an operculum. These spicules are colourless.

This specimen is a female with ova up to 0·1 mm. in diameter.

Specimen F is also fan-shaped in growth, but differs from H in the presence of several anastomoses. It is 160 mm. high × 70 mm. broad, and springs from a spreading base 40 mm. in expanse.

The branches are more slender than in H, most of them being not more than 1 mm. in diameter.

The main stem is soon lost in the general ramification; the axis, which is bare near the base, is 2 mm. in diameter.

The verrucae are similar to those of specimen H, and the shade of red colour is almost the same.

Spicules.—The " Blattkeulen " of F and H are alike, but there is a difference between the two specimens in the relative numbers of the " Blattkeulen " and the spindles.

In an ordinary slide preparation of the spicules of F the number of spindles (up to 0·9 mm. in length) is about equal to the number of " Blattkeulen "; in H the " Blattkeulen " greatly exceed the spindles in number.

Moreover, in F there are many more capstans than in H, where they are very scarce. They are from 0·06–0·07 mm. in length.

This specimen is also female, the eggs being rather more advanced than in H. One egg was 0·3 mm. in diameter, but the largest eggs in most of the polyp cavities were only 0·2 mm. in diameter.

The general appearance of these specimens agrees fairly well with Esper's pl. ixA of *Gorgonia sasappo* var. *reticulata*, although the branches seem to be more slender. Kölliker (1872, pl. xviii, fig. 10) gives an illustration of a large red, irregular spindle of *Echinogorgia pseudosassapo* 0·9 mm. in length, which is an abnormal form of the large red spicule of our specimens. The name of the species was changed to *E. reticulata* by Kükenthal (1924, p. 202).

Our specimens agree with Kükenthal's definition of the species except in one particular. The branches and twigs are not greatly flattened. In one colony described by Nutting from the Malay Archipelago (1910A, p. 64) the branches are said to be flattened, but this is not mentioned as a character of the species either by Wright and Studer (1889, p. 119) in their specimen from Torres Straits, or by Thomson and Dean (1931, p. 205) in a specimen from N. New Guinea.

Echinogorgia umbratica, Esper.

The specimen was obtained in Penguin Channel (Station IX).

It is in the form of a loose flabellum without any anastomoses, 90 mm. high by 70 mm. broad.

A thick stem, 5 mm. in diameter, rises from a thin band of attachment, 9 mm. in length, to any oyster shell.

The branches arise laterally from the main stem, which does not bifurcate, but can be traced right through the colony to the margin of the flabellum. The branches are from 2–3 mm. in diameter and end in slightly swollen knobs. The verrucae are small (1 mm. in diameter), close set and distributed all round the stem and branches. An unusual feature of this specimen is that the verrucae extend the whole way down the stem and there are a few verrucae on the base itself.

The colour is a light brown.

Spicules.—The " Blattkeulen " are very similar in shape to those of *E. furfuracea*, but on the whole rather smaller in size. The larger " Blattkeulen " of *E. furfuracea* are a little over 0·3 mm. long; those of this specimen are a little less than 0·3 mm.

When fully developed they have four or five thick, pointed leaves, which very rarely show any trace of a keel, and four or five heavily tuberculated rootlets.

The smaller " Blattkeulen " (0·2 mm.) have usually three small triangular leaves and three rootlets.

There are several capstans (0·1 mm.) in the preparations.

There are more spindle-shaped spicules in the coenenchym in this specimen than in the specimens of *E. furfuracea*. An exceptionally large one is 0·75 × 0·15 mm., but most of them do not exceed 0·6 × 0·12 mm. in size.

All the spicules are colourless.

There are no gonads in this specimen.

The general form and colour of this specimen resemble the illustration given by

Esper, pl. xx, of *Gorgonia umbratica*, and the spicules agree in form with the figures given by Kölliker (1865, pl. xviii, fig. 495) of *Echinogorgia umbratica.* It is noteworthy that the "Blattkeulen" of this species are much smaller (0·11 mm.) than those of *E. furfuracea* (0·22 mm.) according to Kölliker's measurements.

Echinogorgia umbratica is included in Kükenthal's (1924, p. 204) "uncertain species," and no specimens have been referred to it since the publication of Kölliker's memoir.

This specimen from the Penguin Channel has several characters in common with those of *E. furfuracea* from the same locality (p. 487), and it is possible that it is only a variety of this species. The principal points of difference are that (1) the ramification is less profuse and there are no anastomoses, (2) the "Blattkeulen" are smaller, and (3) the number of large spindle spicules in the coenenchym is greater.

The specimen is much smaller than the larger specimen of *E. furfuracea* in the collection, and it occurred to me that the smaller "Blattkeulen" might be correlated with size, but a careful examination of the "Blattkeulen" of the smaller specimen of *E. furfuracea*, which is not so large as that of *E. umbratica*, has shown that they are approximately as large as those of the larger specimen of *E. furfuracea.*

As regards the size and number of spindle-shaped spicules in the coenenchym, the smaller specimen of *E. furfuracea* is intermediate between the two species. They are more numerous and some of them larger than in the older specimen of that species, but not so numerous, and apparently do not reach the same size as in this specimen of *E. umbratica.*

These statements are based on the examination of a large number of dried spicules from branches of approximately the same size. It is possible that if the investigation had been carried further, so as to include many different parts of each colony (*i. e.* base, stem, terminal twigs, etc.) they might have to be modified.

Genus *Plexauroides.*

No one who has had experience of systematic work in the Gorgonacea can doubt that the genera *Plexauroides* and *Echinogorgia* have many very similar features, and are difficult to distinguish from one another. But according to modern classifications, *Plexauroides* belongs to the family Plexauridae and *Echinogorgia* to the Muriceidae.

In 1884 (p. 338) Ridley said "*Echinogorgia* of Kölliker is nearly allied to *Plexaura*," but since his paper was published the species he described under the name *Plexaura praelonga* has been transferred to the genus *Plexauroides.* With even greater emphasis it may now be said that *Echinogorgia* is nearly related to *Plexauroides.*

If we consider the characters of the Plexauridae and Muriceidae given by Kükenthal (1924), there is found to be no sound reason for placing the two genera in separate families. According to his key plan of the families the Muriceidae have polyps with an operculum (Deckel); in the Plexauridae the polyps have no such operculum. In the more detailed definitions of the families (pp. 89 and 139) the polyps of the Plexauridae are said to be completely retractile or retractile into calices or apparent calices (Scheinkelche). In the Muriceidae the calices are usually higher than they are broad.

In the coenenchym of the Plexauridae there are two layers bearing different kinds of spicules, but no statement is made on this point in the definition of the Muriceidae. There is no clear distinction made between the axes of the two families.

The only clearly defined characters, therefore, which separate the families according to these distinctions is the presence or absence of an operculum or cover to the retracted polyps.

If we compare the definitions of the two genera, *Plexauroides* and *Echinogorgia*, (pp. 124, 198) the differences between are also very slight.

Both genera form fan-shaped colonies, but the branches anastomose in *Echinogorgia* but do not anastomose in *Plexauroides*. The calices, *i. e.* the verrucae, are pronounced in *Echinogorgia*, feebly developed in *Plexauroides*. In both genera the inner layer of the coenenchym bears spindles which are said to be small in *Plexauroides*. In *Echinogorgia* no mention is made of the size of the spindles, but they are said to be accompanied by crosses and other forms.

In the definition of *Echinogorgia* (p. 198), however, the important statements are made that the axis has the typical structure of the Plexauridae and that there are longitudinal canals arranged round the axis.

It may be seen that according to these definitions the two genera are alike in forming fan-shaped colonies, in showing two layers of the coenenchym, of which the outer layer bears "Blattkeulen," and, in some cases at least, the inner layer has longitudinal canals grouped round the axis. The structure of the axis itself is the same in the two genera.

The supposed difference between them as regards the presence or absence of an operculum is found on analysis to be of very uncertain value.

It may be said that Kükenthal (1924) did not make any clear distinction between his terms "Deckel" and "Operculum." They appear to be synonymous.

In the typical species of *Echinogorgia* the retracted polyps are covered and protected by an outer ring of spindle-shaped spicules (the crown), and eight triangular groups of bent spindles meeting by their apices in the centre (the points).

It is true that in *Plexauroides rigida* there are no spicules in the polyps and therefore no operculum, but in *Plexauroides praelonga* and *P. simplex* (Kükenthal, 1910, p. 95, fig. xlix) this armature of spicules shows no difference from that of a typical species of *Echinogorgia*. The verrucae of *Echinogorgia* are usually more pronounced than in *Plexauroides*; but low mound-like verrucae, not to be distinguished from the verrucae of some species of *Echinogorgia*, occur in *P. simplex* (Kükenthal, 1910, pl. i, fig. 3) and in other species of the same genus.

There is also a very well-defined operculum in species of *Euplexaura* (see p. 472).

The axis of these specimens affords no support for the separation of the genera in different families. The axis of every specimen in this collection of both genera has been examined and I can find no distinction of any importance between them.

Nutting (1910*a*, p. 67), in his description of *Echinogorgia flora*, says: "Were it not for the fact that the axis cylinder is devoid of calcareous matter the writer would be much tempted to place this species in the genus *Plexaurella* of the family Plexauridae." This species seems to be identical with Ridley's *Plexauroides praelonga* var. *typica*.

The axis of the smaller specimens and of the branches of the larger ones in both genera is free from calcareous inclusions, but in the stem or larger branches of *E. sasappo*, *E. furfuracea* as well as *Plexauroides rigida* and *P. prœlonga* there is sufficient calcareous matter in the axis to give a distinct reaction with an acid.

The genus *Paraplexaura* (Kükth.) is evidently closely related to *Plexauroides* and to *Echinogorgia*. In discussing its relationship Kükenthal (1919, p. 252) says it is closely related to *Plexauroides*, and differs only from *Echinogorgia* in the absence of an operculum.

The separation of these two genera into different families is obviously very inconvenient and has no scientific foundation. It has probably led to many mistakes in the past and, if retained, will lead to more in the future.

The occurrence in *Plexauroides* of spicules of the type of "Blattkeulen" seems to indicate that the affinities of the genus are closer with the Muriceidae than with the Plexauridae, and the general resemblances as regards the characters of the axis, the canal system and indeed the operculum (when present) of the species of *Plexauroides* and *Echinogorgia* support this conclusion.

For these reasons the genus *Plexauroides* is transferred to the family Muriceidae in this Report.

It is still an open question whether the species of *Plexauroides* should not also be transferred to the genus *Echinogorgia*. If the former generic name is retained there is only one very unsatisfactory character to distinguish the genus from *Echinogorgia*, namely, that the coenenchym is relatively thick and smooth.

In *Echinogorgia* the verrucae are prominent; in fully contracted specimens of *Plexauroides* the verrucae are almost flush with the general surface of the coenenchym. It is this character which gives the species of the latter genus a superficial appearance similar to that of many of the Plexauridae.

Plexauroides rigida, Kükenthal.

The specimen described below (R) was dredged in Penguin Channel (Station XII). It is 180 mm. high, and gives off dichotomously four branches about 30 mm. in length. The diameter of the main stem and branches is approximately 4 mm. The branches are not in the same plane and there are no anastomoses. In a branch 4 mm. in diameter the axis is 1 mm. in diameter.

The surface is covered with verrucae, showing no definite arrangement in lines of spirals. The verrucae are low mounds and measure about 1 mm. at the base.

The colour in spirit is orange red.

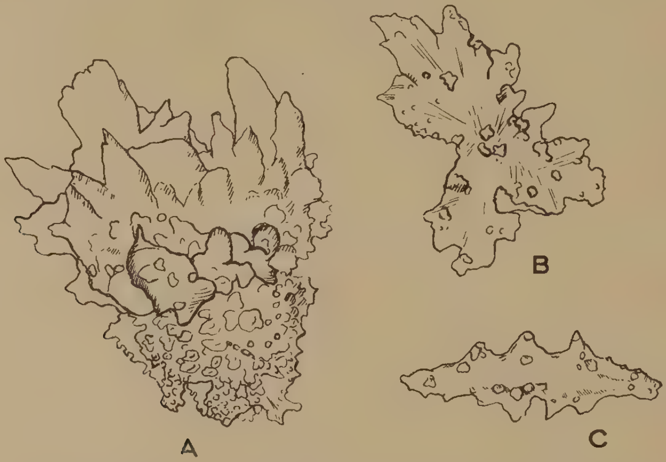
SPICULES.—The majority of the typical "Blattkeulen" are 0·3 mm. in length and approximately the same in breadth, the breadth varying a good deal more than the length. The leaves are narrow triangular plates quite irregularly arranged and the root is characteristically a convex mass covered with tubercles, that is to say, there are usually no prominent rootlets as in the other species.

Among the full-grown "Blattkeulen" in a preparation smaller forms may be found 0·2 mm. in length, with three triangular leaves in a row and three pronounced rootlets, and it appears that as this type of spicule grows, the rootlets increase in thickness to form the convex mass without increasing relatively in length (Text-fig. 11).

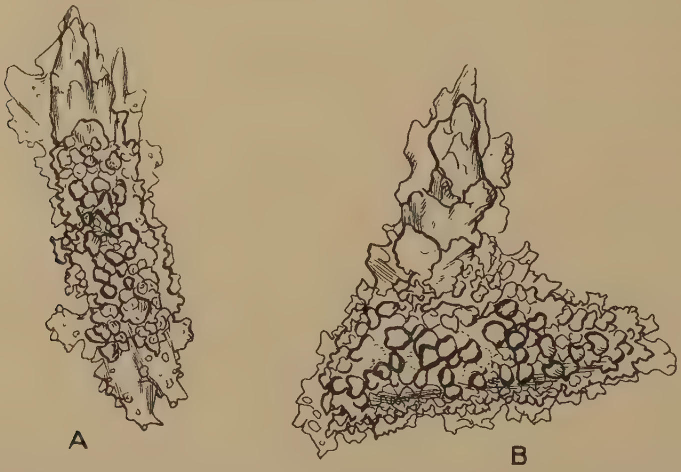
There are a few capstans (0·1 mm.) in this specimen.

The spindles lie beneath the surface of the coenenchym, and attain to a size of 0·5 mm. in length by 0·15 mm. in maximum thickness. They are not all of a simple spindle shape, as some are forked at one end and some larger at one end than the other. One spicule in my preparation is of almost the exact shape, size and colour as the spicule figured for *E. pseudosassapo* by Kölliker in his pl. xviii, fig. 10.

The intermediates are of immense variety but of great interest. In several of them one half is like the leaf cluster of a "Blattkeule" and the other half a spindle. The leaf cluster may be terminal so that the spicule is like a torch, or it may arise on one side only of a spindle-shaped base. Several of these are much larger than the typical "Blattkeulen," attaining a size of over 0·45 mm. in breadth × 0·5 mm. in length (Text-fig. 12).



TEXT-FIG. 11.—*Plexauroides rigida.* A, A very large Blattkeule with the roots fused into a dense convex mass. B, A smaller form with two thick irregular roots. C, One of the spindles from the lower layer of the coenenchym. × 200 diam.



TEXT-FIG. 12.—*Plexauroides rigida.* Two spicules of the coenenchym of irregular form. A, A torch. B, A halbseitige Blattkeule. × 100 diam.

All the larger spicules have a faint pink colour, the spindles being usually more darkly stained than the "Blattkeulen."

The polyps are contracted in the specimen, but the apertures of the verrucae are in many cases sufficiently wide to enable a good view to be obtained of the retracted anthocodiae. No group of spicules forming an operculum can be observed in any polyp, nor can any spicules corresponding in form with the polyp spicules of the species of *Echinogorgia* be seen in the spicule preparations. Dissection of the retracted anthocodiae confirms these observations, and it can be definitely stated that there are no spicules in the anthocodiae and therefore no operculum.

No gonads were found in this specimen.

A smaller specimen (w) from the Penguin Channel, Station IX, consists of a single unbranched stem 70 mm. high springing from a very small disc-shaped base attached to an oyster shell.

The diameter does not exceed 2 mm.

The verrucae are low mounds.

The colour is orange red—almost the same shade as that of the specimen from Station XII.

Spicules.—The "Blattkeulen" agree in form and size with those of the other specimen, and there are several large spindles up to 0·3 mm. in length in the coenenchym. There is no operculum in the polyps.

There can be no doubt that this is a younger colony of the same species as the specimen described above from Station XII.

No gonads were observed.

The type of this species was obtained in 11–12½ metres of water in Shark's Bay, N.W. Australia, and was described by Kükenthal (1910, p. 92).

It was 230 mm. high, was branched in one plane without anastomoses and had an expanse of 110 mm.

The type was therefore much larger than the larger specimen from the Penguin Channel and the ramification much more profuse. Another important point of difference between them is that in the type-specimen the largest spindle-shaped spicules in the coenenchym were only 0·15 mm. in length, whereas in the Penguin Channel specimen there are some 0·5 mm. in length. The colour of the type-specimen was blood red, of our specimen orange red.

On the other hand, they agree in the absence of an operculum and in the form of the "Blattkeulen." The branches in both are circular in section and the diameter of the stem and branches is approximately the same.

Plexauroides praelonga var. *typica*, Ridley.

There are two small specimens dredged in the Penguin Channel, Station XII, which are probably young forms of this variety.

The larger one (z) consists of a stem 95 mm. high with two lateral branches, the longer of which is 50 mm. in length. The diameter of the stem is 3 mm. There is a small base of attachment 9 mm. in diameter without a covering of coenenchym.

The verrucae of the expanded polyps are in the form of low collars. In the contracted polyps these collars are almost flush with the general coenenchym. They are evenly distributed all round the stem and branches but not crowded together.

The colour is orange brown.

Spicules.—The "Blattkeulen" in this species are of the variety called "Schuppenkeulen" by Kölliker, that is to say, they consist of a single broad flat leaf and a root (Text-fig. 13).

In this specimen the prevailing type bears some large tubercles on one side of the leaf and the root has two or three rootlets. The largest are about 0·4 mm. long × 0·3 mm. broad across the leaf.

Variations from this type show a leaf divided into two or three lobes with or without a crenate margin. In some of these there is a definite keel on the leaf, in others several radiating ridges as shown in Ridley's figure (1884, pl. xviii, *g'*).

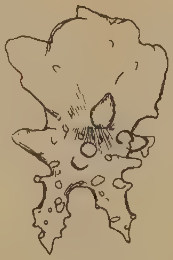
The small " Blattkeulen " have a single smooth leaf with two or three rootlets.

There were no capstans in my preparations of this specimen.

There are several large spindle-shaped spicules visible at the surface. They are variable in size up to a maximum of about 0·75 × 0·3 mm. The side of these spicules exposed at the surface bears longer tubercles than the underside, and some of these tubercles are expanded into triangular or more irregular leaf-like processes.

Some of these surface spicules are oval or disc-shaped, approaching the type of spicules of *Euplexaura robusta*.

In the lower layer of the coenenchym and in close contact with the axis there are numerous small white spicules 0·15–0·3 mm. in length of very varied shapes. Some are simple tuberculate spindles, some spindles with one or more long lateral spines, some crosses, some shaped like knuckle-bones.



TEXT-FIG. 13.—*Plexauroides praelonga.* One of the " Blattkeulen " of the coenenchym. × 100 diam.

The retracted anthocodiae are protected by an operculum of bent spindles similar in arrangement to those of the operculum of the smaller specimen.

All the spicules except those of the anthocodiae are yellow, or, when seen in a heap, orange.

In a piece of the axis 0·75 mm. in diameter there is a chambered core 0·45 mm. in diameter with close-set concave septa, and a thin cortex consisting of tightly compressed fibres. It is not loculated. There is a little calcium carbonate in the axis.

The specimen is female, with ova 0·1 mm. in diameter.

A smaller specimen (cc) has a base of attachment 15 × 7 mm., and consists of a stem 74 mm. high with one short branch.

The base and part of the stem bears no coenenchym. Where the latter is complete the stem is 2·5 mm. in diameter. The verrucae are similar in form and distribution to those of the other specimen (z).

The colour is orange red—a much brighter red colour than the other specimen.

SPICULES.—Most of the " Blattkeulen " consist of a very thin leaf with a smooth outline. The larger ones bear a few tubercles on the outer side of the leaf but they are not keeled. They usually have three short tuberculated rootlets. The largest " Blattkeulen " are 0·3 mm. in length.

There are no capstans.

There are a few pink spindle-shaped spicules in the coenenchym with a maximum length of 0·4 mm., and in my first preparation there are no large spindles or plates similar to those of specimen z, but on examining a little heap of dried spicules I discovered one large sausage-shaped spicule (1·2 × 0·3 mm. in size) with large tubercles, expanding in some cases to small triangular plates on one side and small tubercles on the other.

The retracted anthocodiae are protected by an operculum consisting of slender bent spindles with a maximum length of 0·15 mm. They have the usual arrangement of a crown of two or three circles of spicules, and eight points of two or three spicules which meet more or less "en chevron."

All the spicules of this specimen, except those of the anthocodiae, are pink. When seen in a little heap they are red.

The specimen is male with testes up to 0·3 mm. in diameter. Some of the testes seem to be almost ripe.

Plexauroides praelonga var. *cinerea*, Ridley.

A specimen (v) from the Penguin Channel (Station XII) agrees very closely with Ridley's description of *P. praelonga* var. *cinerea* from 5–10 fathoms at Port Curtis, Queensland.

It is in two pieces; one with the base is 55 mm. high, and the other, without a base, is 120 mm. high. The diameter in the middle of the latter is 4 mm.

Many of the polyps in this specimen are expanded and the surface of the coenenchym round them is smooth—that is to say, there are no verrucae. The polyps are quite irregularly scattered on all sides of the stem.

The colour might be described in Ridley's words as "dirty grey," but "light dirty grey" in this well-preserved spirit specimen rather than dark dirty grey.

SPICULES. The "Blattkeulen" are variable in form, but the prevailing type has a single thin leaf without keel or ribs, but usually some tubercles on the proximal half, and a root with three rootlets, of which the middle one is frequently longer than the two lateral ones.

There are no "capstans."

There are some spindles in the coenenchym which are very variable in size up to a maximum of about 0·6 mm. These have usually longer tubercles on one side than the other.

In this specimen all the spicules are colourless.

The polyps are expanded but probably somewhat contracted by the reagent. The body measures 0·75 mm. × 0·45 mm. and the tentacles 0·45 mm. in length. The body exhibits two regions—a proximal region about 0·45 mm. in length with a thick wall and a distal thin-walled region about 0·3 mm. in length. The thick-walled region is almost unarmed, only a few scattered spindles being observed; at the junction of the thick and thin-walled regions there are a few spindles arranged transversely, forming a crown; in the thin-walled region there are several spindles arranged roughly parallel with the body, and some of these project into the bases of the tentacles. There are no spicules in the tentacles.

I have described the polyps as they are seen in the preparations, but I think it is possible that in life they were more heavily armed, as the surface epithelium seems to be slightly macerated, and some of the spicules may have been lost before the specimens reached me.

The axis of this specimen gives a strong effervescence when treated with an acid. Apart from the presence of more calcium carbonate which this reaction indicates, the structure of the axis is the same as that of the specimen Z of the other variety.

The specimen is male, with testes up to 0·2 mm. in diameter.

A small specimen (Aa) from the same station probably belongs to this variety of the species.

It has a stem 60 mm. high, with one lateral branch springing at right angles from the stem 50 mm. in length. Near the extremity of the branch it is 2·5 mm. in diameter, but becomes more slender towards the base. None of the polyps are expanded in this specimen, and the verrucae are in consequence more pronounced.

The colour is dirty grey.

Spicules.—The " Blattkeulen " are also very variable in this smaller specimen, but the prevailing type is similar to that of the larger specimen. On comparing a group of spicules of each there are clearly more spicules in the smaller form which are provided with tubercles and ridges on the leaves and have a crenate or dentate leaf margin. Moreover, the rootlets are often more numerous and shorter than in the larger specimen. The smallest " Blattkeulen " have a single broad leaf.

In the smaller specimen also there are some spicules which seem to be a compound of a large spindle with a " Blattkeule " of the general type of Kölliker's " halbseitige Blattkeule."

The spindles of the lower layer of the coenenchym are similar to those of the larger specimen.

Although the majority of the spicules are colourless as in other specimens of this variety, it is of some interest that a few of the spicules in this specimen have a faint pink colour.

The armature of the few contracted polyps examined seemed to be similar to that of the other specimen.

Gonads were not observed.

These specimens agree closely with the description of the two varieties of *Plexaura praelonga* by Ridley (1884, p. 339). The type-specimens of the variety " *typica* " were found in 5–11 fathoms of water, on a bottom of sand and shells at Port Curtis and at Port Denison on a rocky bottom, the variety " *cinerea* " at Port Curtis only.

Wright and Studer (1889, p. 138) transferred the species to the new genus *Plexauroides*, and described a specimen (260 mm. high) from Cape York.

Nutting (1910*b*, p. 10) also described a large red specimen from the Aru Islands.

The new species *Echinogorgia flora* from New Guinea described by Nutting (1910*a*, p. 66) almost undoubtedly belongs to the typical variety of this species of *Plexauroides*. His figure (pl. xi, fig. 2) of *E. flora* shows a Gorgonian very similar to the specimen V of *P. praelonga* from the Penguin Channel, and the spicules of that species, as described by Nutting, agree closely with those of this *Plexauroides*.

The absence of calcareous matter in a specimen is no reason for retaining it in the family Muriceidae, as there is great variation in this respect in the Plexauridae, as shown in the axis of the specimens described above (see also Thomson and Dean, 1931, p. 198). This point, however, is of some general interest, as it is another indication of the very close relations of *Plexauroides* and *Echinogorgia*.

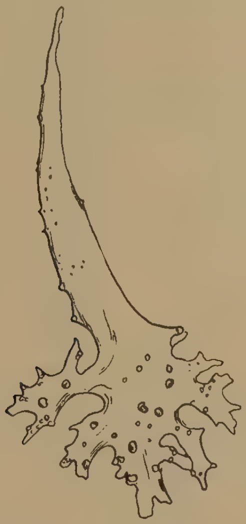
Echinomuricea indo-malaccensis, Ridley.

There is a specimen of this genus from the Penguin Channel, Station IX.

It is 85 mm. high, and has a base of attachment 12 mm. in expanse. The branching is quite irregular and without anastomoses. The base and the lower part of the branches are devoid of coenenchym, and partly enveloped by a mixed population of Polyzoa, sponges and other encrusting organisms (including a species of *Rhabdopleura*). Some of the terminal branches retain the coenenchym, but even this is partly covered by a milk-white encrustation, which consists of white calcareous sand-grains agglutinated together by a kind of slime.

In a word, the specimen looks unhealthy.

However, there is quite sufficient evidence that it is an *Echinomuricea*, and the only specimen of this genus in the collection.



TEXT-FIG. 14.—*Echinomuricea indo-malaccensis.* One of the dagger-shaped spicules on the margin of the verrucae. × 100 diam.

The verrucae are crowded together in some places, but in others there are small stretches of coenenchym between them. The size of the verrucae varies a good deal, but the maximum breadth at the base is about 1 mm. The height of the verrucae depends on the extent of the contraction. The greatest height I have measured is 0·7 mm., but in some verrucae it is less than 0·3 mm. This measurement in contracted spirit specimens is of no specific value, although it might be of some value in specimens with fully expanded polyps.

The calcareous encrustations make it very difficult to determine the surface characters of the verrucae and coenenchym, but I have observed a few dagger-shaped spicules in the coenenchym.

The colour under the encrustations is red.

SPICULES.—The characteristic spicules of this genus are the dagger-shaped spicules, which are found on the edge of the verrucae and more rarely on the coenenchym (Text-fig. 14).

A typical dagger is 0·6 mm. in total length; the blade has smooth edges and is 0·45 mm. in length. At the base of the blade there are a few small pointed tubercles. The hilt consists of 4 or 5 branched, root-like processes.

Other dagger-like spicules have a relatively longer blade or a more complicated hilt, and there is some variation as to the presence of tubercles on the blade. On the whole the blades are remarkably free from such tubercles and have smooth, sharp edges.

Other spicules found in a preparation are the thin bent spindles having a length of about 0·45 mm. and a maximum thickness of 0·03 mm., a number of quite irregular forms and a few crosses.

Nearly all these spicules have a pale pink to a darker orange-pink colour.

The axis is brown, and contains very little calcium carbonate.

The specimen bears male gonads up to 0·27 mm. diameter.

I have examined the type-specimen and its spicules, and there seems to be no reason to separate this specimen from Ridley's (1884, p. 336) *E. indo-malaccensis*, which was found in 5–20 fathoms off the coast of Queensland and in Torres Straits, although it differs from this species by its more irregular branching.

Nutting (1910, p. 56) describes seven species of the genus from the Malay Archipelago and New Guinea. Of his new species, *E. pulchra* from Banda (9–45 metres) has some resemblance to the specimen described above, but I do not consider that there is sufficient reason to separate this species from *E. indo-malaccensis*.

The species was also recorded by Wright and Studer (1889, p. 112) from the Philippines, but according to Hedlund (1890, p. 14), this specimen should be referred to a distinct species, *E. philippinensis*.

Thomson and Henderson (1905, p. 291) recorded the species from the Gulf of Manaar, but the verrucae in their specimens were higher (0·8 mm.) than those of the type (0·3 mm.) and the dagger-shaped spicules rather larger. These differences, however, should not be regarded as of any specific importance. There is a specimen in the collection made by Mr. Bedford at Singapore, of which Mr. Shann made a number of preparations, now in my cabinet. This specimen is undoubtedly identical with that from the Penguin Channel described above as *Echinomuricea indo-malaccensis*.

Genus *Paramuricea* ?

In the collection from the Penguin Channel, Station IX, there is a small Gorgonian which with great hesitation I have assigned to the genus *Paramuricea*. It consists of a single stem 58 mm. high and 1 mm. broad in its greatest diameter, rising from a horny disc of attachment (2·5 mm. diam.) to an oyster shell.

The verrucae are scarcely raised above the surface of the coenenchym, are oval in shape (0·75 × 0·6 mm.), separated by intervals of about 1 mm. but arranged irregularly all round the stem. The coenenchym is very thinly covered with a dense aggregation of spicules.

These spicules are of very variable shape, but some may be seen to be spindles up to 0·3 mm. in length, with large and sometimes branched tubercles. Others are forked, and there are some crosses. They are very difficult to separate in boiling potash, but it seems to be certain that there are some masses of spicules of irregular shape.

The anthocodiae have an armature of narrow, almost smooth spindles about 0·15 mm.

in length, and in retraction they form an operculum very similar to that of some of the species of *Paramuricea*.

The spicules are colourless and the specimen itself light grey.

It is impossible to determine with certainty the generic position of a single specimen of such small size, and a more elaborate study of its structure could not be made without serious mutilation, which did not seem to be justified.

The main point to be emphasized is that it is not a juvenile form of any of the other species described in this paper.

Most of the species attributed to the genus *Paramuricea* are found in European or Atlantic seas. No species have hitherto been described from the Malay Archipelago or from the coasts of Australia.

Family Acanthogorgiidae.

The genus *Acanthogorgia* was formerly included in the family Muriceidae, but was referred to a separate family, together with the genus *Acalycigorgia*, by Kükenthal (1908, p. 37). This rearrangement of the genus was not accepted by Nutting (1910), but the new family name has been more recently adopted by Thomson and Dean (1931). I have already expressed the opinion (1930, p. 250) that the reasons for the separation of the genus from the Muriceidae are not very satisfactory, but may be accepted temporarily until our knowledge of the two families is further extended.

The statement, however, that the species of the family have a purely horny axis (Kükenthal, 1924, p. 237) is subject to some exceptions, as the specimen from the Maldive Archipelago which I described as *Acanthogorgia flabellum* (1905, p. 812) has an axis with a core filled with large calcareous beads. The presence or absence of small calcareous granules in the axis is a character which is too variable for use in the diagnosis of families.

Acanthogorgia studeri, Nutting.

The single small specimen which I attribute to this species was dredged in 20–25 fathoms in the Papuan Pass (Station XXV, 17.iii.29).

It is only 32 mm. high, and consists of a main stem giving off five branches in one plane. It is attached by a small expanded base to a barnacle shell. There are no anastomoses of the branches.

The stem and main branches are of approximately the same thickness. The axis is 0·15 mm. in diameter, and this is covered by a thin transparent coenenchym 0·075 mm. in thickness.

The verrucae stand up from the coenenchym and are quite irregularly arranged, crowded at the distal ends of the branches, scattered on the main stem. They are cylindrical or hemispherical in shape according to their age or degree of contraction. The largest cylindrical form I have measured is 0·65 mm. in height and 0·45 mm. in diameter; the hemispherical or knob-shaped verrucae are about 0·45 mm. in diameter. The spines forming a crown round the top of the verrucae, which are a characteristic feature of the genus, are shorter than in most species.

The colour is pale brown, but the dark gold axis can be seen through the almost transparent coenenchym.

The spicules of the coenenchym are straight or bent spindles of various sizes, up to a maximum of about 0·35 mm. in length by 0·07 mm. in thickness; some of them have very prominent tubercles, as shown in Nutting's figure (1910, pl. xix, fig. 3). In others the tubercles are short convex projections. There are also a few crosses and irregular shaped spicules.

The spicules of the walls of the verrucae are similar to the spindles of the coenenchym. In the cylindrical verrucae they are arranged transversely to the axis of the polyp, in the hemispherical and knob-shaped verrucae more irregularly, with an approach to chevron arrangement in some cases.

The characteristic spicules of the margin of the verrucae consist of a spine 0·3 mm. in length, and a root usually bent at a wide angle to the spine 0·2 mm. in length. Both spine and root bear more tubercles than in this type of spicule of most of the species of this genus.

There are no gonads in this specimen.

The identification of this specimen may be open to some doubt, as it is very small and possibly only a juvenile form of another species.

According to Nutting (1910, p. 20), the type shows anastomoses of the branches to a limited degree, and the verrucae are 2 mm. in height, or more than twice as large as they are in this small specimen, but in the characters of the spicules the specimen agrees more closely with *A. studeri* than with any other species.

A study of the growth stages in a number of specimens of a single species from one locality seems to be necessary before specific determination in this genus can be satisfactorily made. It is probable in this case that the specimen described above is a young growth stage of *A. studeri*, but this species may in its turn be only a growth stage of such a species as *A. laxa*.

The genus has a very wide geographical and bathymetrical distribution and there are 28 species in Kükenthal's list (1924, p. 28). Nutting (1910) describes twelve species from the Malay Archipelago, and to this list Thomson and Dean (1931) add one more. It is rather surprising, therefore, that this is the first record of the occurrence of a species of the genus in Australian waters.

Family GORGONELLIDAE.

Genus *Juncella*, Val.

The original name given to a species of this genus by Valenciennes in 1855 was *Junceella*. Five years later its form was quite rightly corrected to *Juncella* by Milne Edwards and Haime, and until quite recently the genus has been called *Juncella* in the extensive literature on the subject by subsequent authors. *Juncella* should be retained as a *nomen conservandum*.

The genus can be distinguished from the other genera of the family by the characteristic club-shaped spicules of the outer layer of the coenenchym.

Juncella gemmacea, Valenciennes.

Two pieces of this species were dredged in the Penguin Channel (Station XII). They may be only branches of a large colony, but they are large enough to show the apparently dichotomous branching. The terminal branches of these two specimens have a maximum length of about 100 mm. They have a diameter of 3·5 mm., including the verrucae, and taper gradually to a blunt point.

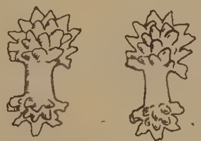
The verrucae are distributed evenly all round the branches, leaving no bare tracks such as are described in many specimens. They are about 2 mm. in length and 0·5 mm. in diameter, and are bent upwards towards the growing point with a slight inward bend. In many places they are so crowded together that they almost overlap.

The colour of these branches is orange red.

The spicules of the outer layer of the coenenchym are of the type, characteristic of the genus, called by Kölliker " unsymmetrische Doppelkeule " and by Simpson " clubs " (Text-fig. 15). They are pale yellow in colour and approximately 0·1 mm. in length. In the inner layer of the coenenchym the spicules are capstans of the type called " Doppelstern " by Kölliker. They are of the same length as the clubs, but colourless.

The figures of these two types of spicules in *Juncella juncea* given by Kölliker (1865, pl. xviii, figs. 45 and 46) resemble very closely the spicules in these specimens.

The specimens are so completely retracted that no parts of the anthocodiae protrude from the mouths of the verrucae, and therefore the only way to study the armature of the anthocodiae is by dissection. The tightly contracted anthocodiae thus released are colourless and apparently free from spicules. I can find no evidence of the small warted rods which, according to Toeplitz (1929, p. 270), fill the tentacles (erfüllen dicht die Tentakel) in *J. juncea*.



TEXT-FIG. 15.—*Juncella gemmacea.* Two of the club-shaped spicules at the surface of the coenenchym. × 200 diam.

It may be that Simpson and Toeplitz were able to examine the fully expanded anthocodiae of some of the species they described ; but in my experience the description of the armature of the polyps based on the examination of anthocodiae dissected out of tightly contracted verrucae is apt to be very misleading.

The axis has the usual straw colour of the Gorgonellids and gives rapid effervescence in hydrochloric acid. It is deeply grooved for the longitudinal canals. There are twelve grooves in a part of the axis 1 mm. in diameter.

The specimen is male, with testes 0·2 mm. in diameter.

This species was recorded from various localities off the coast of Queensland by Ridley (1884, p. 346), and from the Aru Islands and the Timor Sea by Nutting (1910, p. 20). It was thoroughly investigated by Simpson (1910, p. 294). Toeplitz considered the species to be a variety only of *Juncella juncea*, and this view was accepted by Kükenthal (1924). There can be no doubt that the two species are closely related, but the dichotomous branching of the specimens of *J. gemmacea* forms a sufficiently distinct character to justify their separation for the present.

The specimens from the Penguin Channel differ from most of the descriptions of the species in having no bare tracks between the verrucae. The verrucae are distributed all round the branches.

Genus *Scirpearia*, Studer.

The name *Scirpearia* was first introduced by Cuvier for an Alcyonarian which, by some subsequent authors, was considered to be a Pennatulid and by others a Gorgonian (see Simpson, 1910, p. 307). On the strength of this Nutting declared that the name should be abandoned and most of the species referred to the genus *Scirpearella*. Toeplitz (1929) has, however, expressed the opinion that it should be retained as one of the *nomina conservanda*.

Studer (1878, p. 660) gave a short definition of the genus based on the examination of specimens which were certainly Juncellids.

Simpson (1910, p. 277) after a thorough analysis of the characters of a large number of species, came to the conclusion that *Ctenocella*, *Ellisella* and *Scirpearella* could not be distinguished from one another generically, and united them into the one comprehensive genus *Scirpearia*.

Kükenthal (1924), on the strength of the work of Toeplitz, has resuscitated the genera *Ctenocella* and *Ellisella*.

My own investigations on the materials collected by the Barrier Reef Expedition, and on specimens in my own collection from various localities, lend support to Simpson's view that *Scirpearia*, *Scirpearella* and *Ellisella* cannot be separated, but I would plead for the retention of the genus *Ctenocella* (see p. 509).

The principal differences between *Scirpearia* and *Ellisella* according to Toeplitz are that in *Scirpearia* " die Tentakeln sind bei allen Arten der Gattung bewehrt mit Doppelspindeln, die Uebergange zu Gürtelspindeln zeigen können " (1929, p. 293), but in *Ellisella* "Die Bewehrung der letzteren (*i. e.* the Polyps) geschieht durchweg durch zwei Formen von Spicula, kleine unregelmässig bewartzte Stäbchen in den Tentakeln und stachelige Skleriten in der Polypenbasis " (*loc. cit.*, p. 274).

These statements do not agree with those of Simpson (1910, p. 264), who says that in *Scirpearia* (+ *Ellisella* + *Ctenocella*), " the tentacles bear a number of small flat, scale-like spicules on the aboral surface. These are very easily overlooked in a preparation; and in fact they are so similar *in all species* as to be of no specific importance, so that their inclusion in each individual description is hardly necessary."

A very careful examination of the armature of the anthocodiae of the only specimen in this collection has been made, with the result that, in my opinion, the distinction between the two genera cannot be maintained.

Scirpearia elongata, Pallas.

Two branches of the Juncellid which I have referred to this species were also dredged in Penguin Channel (Station XII).

They are 240 and 190 mm. respectively in length. At the proximal end of the larger one there is a fork, but one of the branches is broken off near its origin, leaving only a short stump. Just below the fork it is 5 mm. in diameter, the axis is 3·5 mm. in diameter and the coenenchym about 0·75 mm. thick. The terminal branches at a distance of 20 mm. from the distal end have the axis 0·75 mm. in diameter and the coenenchym about 0·25 mm. in thickness.

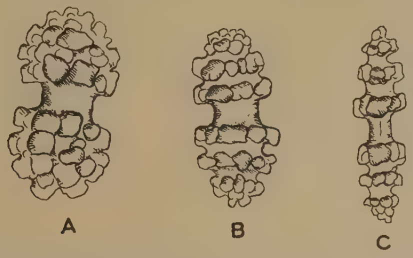
The verrucae are small blunt cones turned slightly upwards, 0·75 mm. in height and about 0·5 mm. in diameter at the base.

They are arranged quite irregularly all round the distal ends of the branches, but in some places near the proximal ends of the branches they are arranged laterally, leaving two broad bare tracks, in one of which there is a shallow groove.

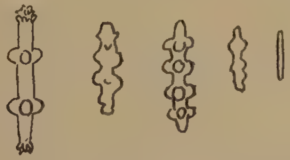
The colour is orange red.

The spicules of the coenenchym consist of "capstans" ("Doppelstern"), and more elongated forms which might be called double clubs. The larger capstans are about 0·058 × 0·054 mm. and the larger double clubs ·07 × ·03 mm. (Text-fig. 16). They agree very closely in form and size with the coenenchym spicules described and figured by Simpson (1910, p. 327, pl. ix, fig. 48) for this species.

It is very difficult to determine the exact arrangement of the spicules of the anthocodiae by dissection of the contracted verrucae. In this specimen there are a few verrucae, from the apertures of which a part of the tentacles protrude, and by the study of these and numerous dissections the following notes have been prepared: (1) The aboral side of the tentacles bears a row of spicules extending from the base to the apex. (2) The pinnules bear no spicules. (3) The thin body-wall of the anthocodia bears a few spicules 0·04 × 0·01 mm. in size, with two girdles of four tubercles and a tuft of small tubercles at each end. (4) Between the base of the body-wall of the anthocodia and the verrucae there is a cluster of small spindle-shaped spicules of various sizes up to a maximum length of about 0·06 mm.



TEXT-FIG. 16.—*Scirpearia elongata.* Three spicules of the coenenchym. A, A capstan. B, An intermediate form. C, A double club. × 400 diam.



TEXT-FIG. 17.—*Scirpearia elongata.* Spicules from the aboral side of a single tentacle. × 500 diam.

The question whether these spindle-shaped spicules really belong to the anthocodia or the verruca can only be determined by the examination of fully expanded polyps.

The spicules of the tentacles diminish in size from the base to the apex, where they are, as Simpson described them, thin scales (Text-fig. 17). In the basal parts they vary in form, some being double clubs, some with regular girdles, and some, with irregularly distributed tubercles; in fact spicules corresponding in form with the spicules of the tentacles figured by Toeplitz for both genera (*Scirpearia* and *Ellisella*) can be seen in one tentacle of this species.

The axis is straw-coloured and highly calcified. In a section of a decalcified branch 1·8 mm. in diameter between the verrucae, the axis is 1·3 mm. in diameter and the coenenchym 0·25 mm. thick and there are twelve longitudinal canals, of which two on opposite sides of the branch are much larger than the others.

The specimen is female with small ovaries. One or two ova 0·2 mm. in diameter were found, but in most cases the ova did not exceed 0·1 mm.

This species is supposed to be identical with the *Gorgonia elongata* of Pallas. The specimens have been referred to it with some hesitation, but after a careful consideration of the extensive literature on the family, I have come to the conclusion that these Juncellids are far more variable than they are generally assumed to be, and that most of the new species that have been proposed are only local variations of one wide-spread species.

Simpson (1910, p. 325) has given a full account of a specimen of this species from the West Indies in the collection of the Royal College of Surgeons, and if the specimens described above are the terminal branches of a much larger colony, they agree closely with this description in all essential characters. The only species of the genus which has been recorded from the Barrier Reef is *Ellisella calamus* (Ridley, 1884, p. 348), referred by Simpson to the genus *Scirpearia.*

The species was referred back to the genus *Ellisella* by Toeplitz, and our specimens agree with his definition of that genus in having spicules in the verrucae of the same kind as those in the general coenenchym, but differ from it in having much more slender branches and a relatively thin coenenchym.

There is apparently no sound specific difference between the specimens from the Penguin Channel and the specimen of *Scirpearia elongata* from the West Indies in the Hunterian Museum described in detail by Simpson (1910, p. 326). It is possible that when fully expanded specimens of the *Scirpearias* from these two widely separated localities can be examined and the armature of the polyps accurately determined, some important differences between them may be discovered.

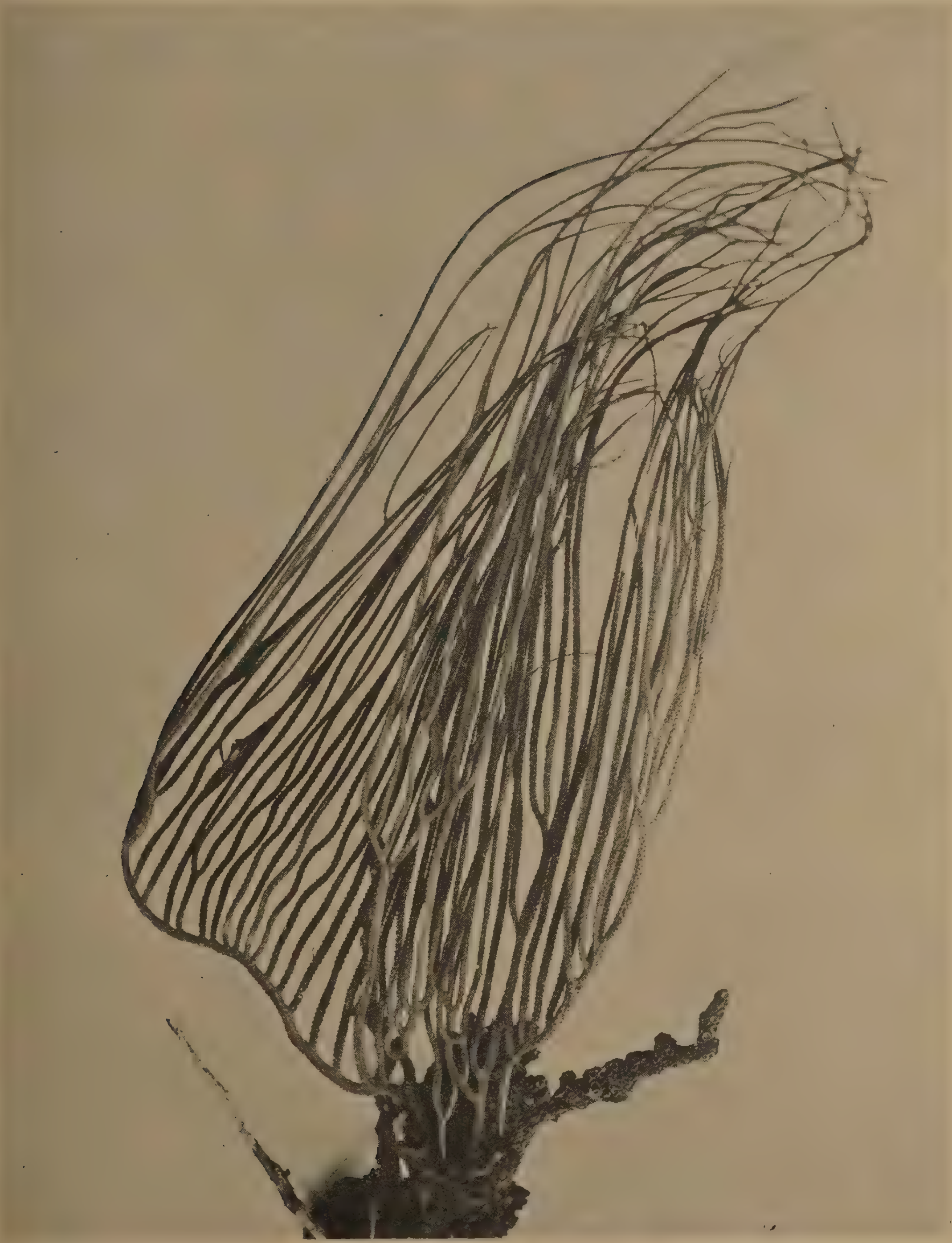
But until this time the species must be considered to have a very wide geographical distribution with only slight local variations.

Ctenocella pectinata, Pallas.

A fine specimen of this well-known species was found in 7 fathoms of water inside the Wentworth Reef (Station XI, 23.ii.29) (Text-fig 18). The Wentworth Reef is a submerged patch of coral near Port Douglas. This is the specimen figured by Dr. Yonge on his pl. xxxix A, opp. p. 133, as a " horny coral or Gorgonid." Two small specimens, probably of the same species, were also obtained from the Penguin Channel (Station XII) on the following day.

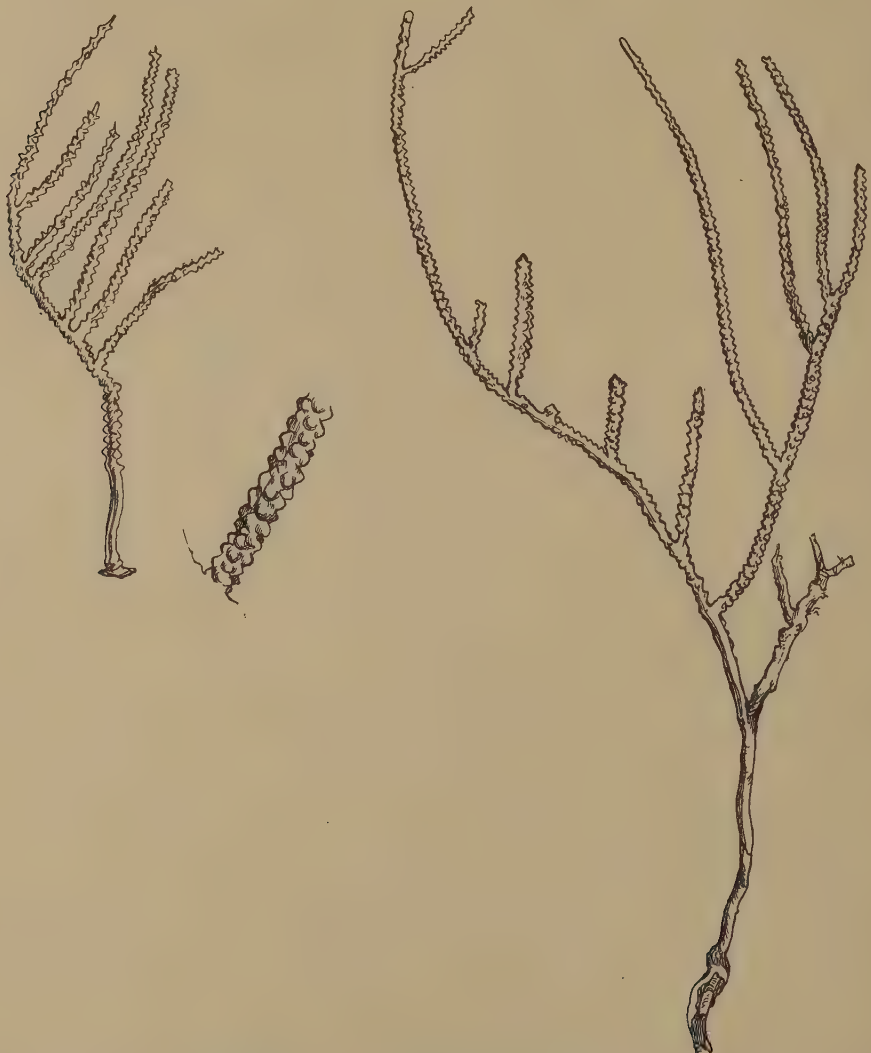
The large specimen is about 600 mm. high and has an expanse across the shoulders of about 250 mm. The thickest part of the stem is 30 mm. in diameter and the branches about 2·5 mm. in diameter. The verrucae are low mounds, and about 1 × 0·75 mm. in size at the base. The arrangement of the verrucae varies in different parts of the same branch. In some places there is a distinct bare track on both sides between two lateral groups of verrucae; in others there is no bare track on one side, and in considerable lengths the verrucae entirely surround the branches. In some places the verrucae are arranged in a spiral manner round the branches but in others the arrangement is quite irregular.

The colour of these specimens is red.



TEXT-FIG. 18.—*Ctenocella pectinata.* From a photograph of the large specimen from Wentworth Reef. × $\frac{1}{3}$.

The spicules of the coenenchym agree very closely with the description given of them by Simpson. They differ from the spicules of the specimen of *Scirpearia* in having a narrower band between the stellate extremities, and in many cases odd tubercles are found on the bar itself (Text-fig. 20). They are approximately 0·057 mm. in length.



TEXT-FIG. 19.—*Ctenocella pectinata.* Two young specimens. The one on the right is T_1, and the one on the left is T_2. Nat. size. At the side of T_2 there is a part of a branch enlarged.

There is no satisfactory account of the spicules of the anthocodiae of this genus or species. According to Simpson (1910, pp. 264), they are similar to those of the species of *Scirpearia*. According to Toeplitz (1929, p. 319 and 327), the tentacles bear slender rod-shaped sclerites 0·046 mm. in length. I have found some spicules similar in size and shape to those described by Toeplitz, but in my dissections of these small, tightly contracted verrucae it was not possible to obtain a clear idea of the armature of the anthocodiae when expanded. The polyp cavities were filled with nearly ripe testes with a maximum diameter of 0·5 mm.

The two small specimens from Station XII present some features of interest (Text-fig. 19).

The larger one (T_1), having no base of attachment, is 140 mm. high. The lower part of the stem is dead, the coenenchym being brown and degenerate. It divides, 40 mm. from the lower end, dichotomously, but one of the two branches is also dead 30 mm. in length and covered with epizoites.

The other branch, however, is normal, and at a distance of 15 mm. from the fork divides again dichotomously, to give rise to an almost typical bipectinate flabellum, the secondary branches arising on the inner side of the two main divisions of this branch.

No gonads were observed in this specimen.

The smaller one (T_2) is 80 mm. high and has a small base of attachment 3 mm. in diameter. The form of this specimen may be said to be mono-pectinate. The main stem at a distance of 25 mm. from the base bends sharply to one side, and on the opposite side to the bend gives rise to six secondary branches 25–35 mm. in length.

The specimen is a female with ova up to 0·45 mm. in diameter.

These two specimens are smaller than any of those examined by Simpson (1910, p. 320), which were apparently all normal in their bipectinate form.*

The larger form is of interest, as it shows that having failed at the first attempt to form a bipectinate flabellum owing to the death of one of its branches, it has made by another dichotomy a second and successful attempt.

The smaller one, although abnormal, shows the characteristic branching from one side only of a typical flabellum.

These young forms seem to indicate that in this genus the bipectinate form of growth is an important genetic character which manifests itself at an early stage in development.

This well-known species has been previously described by several authors from Australian waters. It is distributed throughout the Malay Archipelago to the coasts of Burma, and has been found in various localities in the Indian Ocean. The same species also occurs in the West Indies (Ridley, 1884, p. 349).

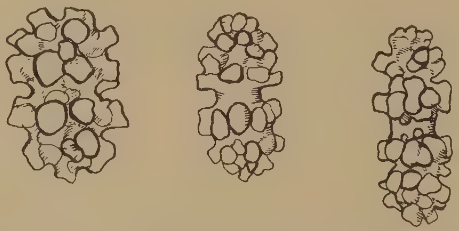
There can be no doubt that the genus *Ctenocella* is closely related to *Scirpearia*, and that there is great force in Simpson's (1910, p. 277) arguments in favour of the inclusion of the species in the genus *Scirpearia*. The unique and characteristic method of branching, usually called "lyre form," or better, "bipectinate," is so definite and easily recognized that it is convenient to keep the species in a distinct genus. This is not the only reason, nor a sufficient one in itself, to justify the retention of the genus. As Simpson (*loc. cit.*, p. 318) points out, there is a difference between this species and *Scirpearia* in the spiculation. This difference might easily be overlooked, because at first sight the spicules of a *Scirpearia* and a *Ctenocella* seem to be exactly alike in size and in outline, but, as Ridley pointed out (1884, p. 349), in *Ctenocella pectinata* the two inner whorls of the verruca spicules almost meet in the middle, "so as to obliterate the median bare zone, which is characteristic of the cortical spicules" (Text-fig. 20).

After a careful examination of several preparations of the *Scirpearia* and of each of the three specimens of *Ctenocella* in the collection, I can not only confirm Ridley's observation, but find a further difference in that the bare zone of the ordinary cortical spicules is usually narrower and more frequently partially obliterated by the presence of odd tubercles on it.

---

* There is some confusion in Simpson's table of measurements, as in the column of the diameter of the main stems *cm.* is probably a misprint for *mm.* A main stem 3 cm. in length by 10·5 cm. in diameter is impossible.

In comparing the canal system of these specimens of *Ctenocella* with that of the specimen of *Scirpearia*, I have observed a difference between them which may be of some importance. In a terminal branch of *Ctenocella* there are two very large longitudinal vessels connected by a network of capillaries. In a branch of *Scirpearia* of the same diameter there are two large longitudinal vessels, as well as several smaller longitudinal vessels surrounding the axis.



TEXT-FIG. 20.—*Ctenocella pectinata.* Spicules of the coenenchym. × 400 diam.

It is possible that further investigation will emphasize the difference between the two genera, as we have very little information concerning many important features of their anatomy. There is no satisfactory account, for example, of the armature of the expanded anthocodiae of *Ctenocella*, and the short statements that have been made on this character are not in agreement (see Toeplitz, 1929, p. 323).

Until the time when fully expanded specimens of the two genera have been examined and described it is better to retain the genus *Ctenocella*, rather than merge this interesting species with those of *Scirpearia*.

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INDEX

PAGE
Acanthogorgia 501
appressa, Suberogorgia 467
aruensis, Euplexaura 473
australiensis, Leptogorgia 460

bebrycoides, Discogorgia 475
,, Placogorgia 474
Birotularia 470

calamus, Ellisella 506
crassa, Muricella 480
Ctenocella 504, 509

Discogorgia 473, 474

Echinogorgia . . 481, 491, 492, 493, 498
Ellisella 504
elongata, Scirpearia 504, 506
Euplexaura 475

flabellata, Euplexaura 472
flabellum, Antipathes 487
,, Echinogorgia 487
flora, Echinogorgia . . . 485, 492, 498
furfuracea, Echinogorgia . 463, 481, 485,
489, 490, 491
,, Gorgonia 487

gemmacea, Juncella 502

hippuris, Isis 470

indo-malaccensis, Echinomuricea . . 499
juncea, Juncella 503
Juncella 459, 469

mertoni, Echinogorgia 485
Muriceidae 475, 491

PAGE
ochracea, Isis 469
,, Melithaea 469
,, Melitodes 469

Paramuricea 500
Paraplexaura 492
pectinata, Ctenocella 506
perramosa, Muricella 475
Placogorgia 474
Plexauridae 470, 491
Plexauroides . . . 491, 492, 493, 498
praelonga, Plexaura 498
,, Plexauroides 481
,, var. cinerea, Plexauroides . . 497
,, ,, typica, ,, . 492, 495
pseudosassapo, Echinogorgia . . 490, 493
pulchra, Echinomuricea 500

reticulata, Echinogorgia . . . 482, 489
rigida, Plexauroides 492, 493
robusta, Euplexaura 470

sasappo, Echinogorgia . . . 481, 483
,, Gorgonia 485
,, var. reticulata, Gorgonia . . 490
Scirpearella 504
sphaerophora, Echinogorgia . . 482, 488
splendens, Birotularia 470
squamosa, Melitodes 469
stenobrochis, Gorgonia 461
studeri, Acanthogorgia 501
suberosa, Gorgonia 468
,, Sclerogorgia 468

tenera, Muricella 476

umbratica, Echinogorgia . . . 483, 490
,, Gorgonia 491

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INVESTIGATIONS

SPONGES

BY

MAURICE BURTON, M.Sc.,
Assistant Keeper in the Department of Zoology.

WITH THIRTY-THREE TEXT-FIGURES AND TWO PLATES.

	PAGE
Introduction	513
Table showing Distribution of Species Collected by the Expedition on the Great Barrier Reef	515
Systematic Notes on the Collection	518
Sponges of the Savile Kent Collection from the Great Barrier Reef: With a Note on Callyspongia ramosa (Gray)	596
List of Works Referred to	609
Index	615

INTRODUCTION.

The study of the collection of sponges brought home by the Great Barrier Reef Expedition has added few new names to our lists of the Australasian species, but has provided a valuable addition to our knowledge of the fauna of the Australian coasts. Practically nothing was known hitherto of the sponge-fauna of the Great Barrier Reef. But more valuable still is the opportunity afforded to overhaul our knowledge of the sponges of this region, especially with regard to their nomenclature.

The sponges collected by the Expedition belong, for the most part, to species characteristic of the Indo-Pacific. Many of these are common also to the coasts of Australia, and the results of the present investigation suggest that, in the region explored, a mixing of the Australian and Malayan sponge-faunas takes place. This broad generalization, in itself inconclusive and unsatisfactory, is the most that can be said. A more detailed analysis is impossible until our knowledge of the sponge-fauna of Australia is brought up to date, for, although a formidable list of species has been recorded from various parts of the Australian coast, most of them are either inadequately described or wrongly classified.

There are two further points worthy of mention here. In the first place, the species represented in a collection made by Savile Kent in some unstated part of the Barrier Reef are predominantly Australian, in striking contrast to the collection made by the present Expedition. It is probable, therefore, that the generalization made above regarding the Low Isles area is not true of the whole of the Barrier Reef. The second point concerns the occurrence of species on the Barrier Reef which are also found in the West Indies, Azores and Mediterranean. Although it is not possible here to enter into details, this raises a problem of first-rate importance which would justify close investigation. When we turn to the sponge-faunas of the Indian Ocean and the Malay area we find that there are many species showing this same distribution. So far as can be seen at present, the line of their distribution follows through from the Malay area and Indian Ocean, round the most southerly point of the African continent, up its west coast to the Azores and thence into the West Indies on the one hand and the Mediterranean on the other. Moreover, these same species do not seem to occur outside this area. It is possible that a detailed study of this problem may shed interesting light on the migration of species and the factors limiting distribution.

The ecology of some of the sponges has been dealt with in Vol. III, No. 2, of the Barrier Reef Reports, but since that report was published certain of the names have been altered.

These, with their present equivalents, are given below :

Names used in Vol. III, No. 2.		Names used in present Report.
Chalina clathrata	=	*Haliclona clathrata* (Dendy).
C. camerata	=	*H. camerata* (Ridley).
Gellius toxius	=	*Adocia toxius* (Topsent).
G. sagittarius	=	*A. sagittaria* (Sollas).
G. pumilus	=	*A. pumila* (Lendenfeld).
G. fibulatus	=	*A. fibulatus*, var. *microsigma*, Dendy.
Cladochalina pulvinatus	=	*Callyspongia diffusa* (Ridley).
Polymastia sp.	=	*P. megasclera*, sp. n.
Phyllospongia foliascens	=	*Carterispongia foliascens* (Pallas).
P. ridleyi	=	*Druinella ramosa*, Thiele.
Euspongia irregularis, var. *pertusa*	=	*Spongia officinalis*, Linnaeus.
Spongelia digitata	=	*Dysidea fragilis* (Montagu).

TABLE SHOWING DISTRIBUTION OF SPECIES COLLECTED BY THE EXPEDITION ON THE GREAT BARRIER REEF.

Species.	Australia.				Malay area.	Indian Ocean, including Red Sea.	Further distribution.
	North coast.	East coast.	South coast.	West coast.			
Order CALCAREA	..	..	..	..	..	..	..
Family Leucascidae	..	..	..	..	..	..	..
Pericharax heteroraphis (Poléjaeff)	..	..	..	..	×	×	Tristan da Cunha.
Family Sycettidae	..	..	..	..	..	..	..
Sycon gelatinosum (Blainville)	..	×	×	×	×	..	..
Family Heteropiidae	..	..	..	..	..	..	..
Leuconia ramosa, sp. n.	..	..	..	..	..	..	..
Order TETRAXONIDA	..	..	..	..	..	..	..
Sub-Order HOMOSCLEROPHORA	..	..	..	..	..	..	..
Family Plakinidae	..	..	..	..	..	..	..
Corticium candelabrum, Schmidt	..	..	..	..	×	..	Mediterranean.
Oscarella tenuis, Hentschel	..	..	×	×	..	..	..
Sub-Order ASTROSCLEROPHORA	..	..	..	..	..	..	..
Family Stellettidae	..	..	..	..	..	..	..
Stelletta purpurea, Ridley	×	×	..	..	×	×	Antarctic; New Zealand.
S. clavosa, Ridley	×	..	..	×	×	×	..
Ancorina agglutinans (Thiele)	..	..	..	..	×	..	..
Jaspis stellifera (Carter)	×	..	×	..	..	..	..
Family Chondrosiidae	..	..	..	..	..	..	..
Chondrilla nucula, Schmidt	×	×	..	..	×	×	New Zealand; Azores; W. Indies; Mediterranean.
C. australiensis, Carter	..	×	..	..	×	×	..
Sub-Order SIGMATOSCLEROPHORA	..	..	..	..	..	..	..
Family Tetillidae	..	..	..	..	..	..	..
Cinachyra australiensis (Carter)	..	×	×	..	×	×	Philippines.
Raphidotethya enigmatica, sp. n.	..	..	..	..	..	..	..
Family Haplosceridae	..	..	..	..	..	..	..
Haliclona camerata (Ridley)	..	..	..	..	×	×	..
H. reticulata (Lendenfeld)	..	×	..	..	..	× ?	..
H. clathrata (Dendy)	..	..	×	..	×	..	New Zealand.
H. exigua (Kirkpatrick)	..	..	..	..	×	..	..
H. pigmentifera (Dendy)	..	..	..	..	..	×	..
H. tenuispiculata, sp. n.	..	..	..	..	..	..	..
H. flabello-digitatus, sp. n.	..	..	..	..	..	..	..
Adocia toxius (Topsent)	..	..	..	..	×	×	..
A. minor (Dendy)	..	..	..	..	..	×	..
A. obtusa (Hentschel)	..	..	..	..	×	..	..
A. pumila (Lendenfeld)	×	..	..	..	×	×	..
A. sagittaria (Sollas)	..	..	..	..	×	..	..
A. fibulatus, var. *microsigma*, Dendy	..	..	..	..	..	×	..
Petrosia strongylata, Thiele	..	..	..	..	×	..	..
Callyspongia diffusa (Ridley)	..	..	..	..	×	..	..
C. subarmigera (Ridley)	×	×	..	..	×	..	..
C. fibrosa (Ridley and Dendy)	..	..	..	..	×	×	..
C. confoederata (Ridley)	×	×	..	×	×	..	..

Species.	Australia.				Malay area.	Indian Ocean, including Red Sea.	Further distribution.
	North coast.	East coast.	South coast.	West coast.			
ORDER TETRAXONIDA—*cont.*							
SUB-ORDER SIGMATOSCLEROPHORA—*cont.*							
Family HAPLOSCLERIDAE—*cont.*							
C. clathrata (Dendy) . .	..	..	..	..	..	×	..
C. ridleyi, sp. n. . . .	..	×	..	..	..	..	..
Oceanapia fistulosa (Bowerbank)	×	..	..	×	×	×	Azores ; Bahia.
O. renieroides, sp. n. . .	..	..	..	..	..	..	..
O. elastica (Keller) . .	..	..	..	..	×	×	..
Family DESMACIDONIDAE .	..	..	..	..	..	..	..
Section ISODICTYEAE . .	..	..	..	..	..	..	..
Desmapsamma, gen. n., *anchorata* (Carter) . .	..	..	..	..	×	..	West Indies ; Bahia.
Section MYCALEAE . .	..	..	..	..	..	..	..
Mycale grandis, Gray . .	..	..	..	..	×	..	..
M. sulevoidea (Sollas) . .	..	..	..	..	×	..	..
Section MYXILLEAE . .	..	..	..	..	..	..	..
Histoderma calcifera, sp. n. .	..	..	..	..	..	..	..
Hamigera strongylata, sp. n. .	..	..	..	..	..	..	..
Plumocolumella anchorata (Carter)	..	..	×	..	..	..	..
Strongylacidon inaequalis (Hentschel) . . .	..	..	×	×	..	..	..
S. intermedia, sp. n. . .	..	..	..	..	..	..	..
Psammochela fibrosa (Ridley) .	×	..	..	..	..	×	..
Chondropsis chaliniformis (Carter)	×	×	×	..	..	..	Antarctic.
C. carcinophila (Lendenfeld) .	..	×	..	..	..	..	..
Iotrochota purpurea (Bowerbank)	..	..	..	..	×	×	..
I. coccinea (Carter) . .	..	..	×	..	..	..	..
Crella spinulata (Hentschel) .	..	..	×	×	..	..	..
Hymedesmia mertoni, Hentschel	..	..	..	..	×	..	..
H. tenuissima (Dendy) .	..	..	..	..	..	×	..
Paracornulum dubium (Hentschel)	..	..	..	..	×	..	..
Section CLATHRIEAE . .	..	..	..	..	..	..	..
Clathria aculeata, Ridley .	×	..	..	..	..	..	..
C. rubens (Lendenfeld) .	..	×	..	..	..	..	..
C. eccentrica, sp. n. . .	..	..	..	..	..	..	..
Tenacia frondifera (Bowerbank)	×	..	..	..	×	×	..
T. procera (Ridley) . .	×	..	..	..	..	×	..
T. paucispina (Lendenfeld) .	..	×	..	..	..	..	..
T. coralliophila (Thiele) .	..	..	..	..	×	..	..
Ophlitaspongia rimosa (Ridley)	..	..	..	..	..	×	..
O. eccentrica, sp. n. . .	..	..	..	..	..	..	..
Protophlitaspongia, gen. n., *oxeata*, sp. n. . . .	..	..	..	..	..	..	..
Echinochalina intermedia (Whitelegge) . . .	..	×	..	..	..	×	..
E. anomala, Hallmann .	..	×	..	..	..	..	..
Coelocarteria, gen. n., *singaporense* (Carter) . .	..	..	..	..	×	..	..
Family AXINELLIDAE . .	..	..	..	..	..	..	..
Trachyopsis aplysinoides (Dendy)	..	..	..	..	..	×	..
T. halichondrioides, Dendy .	..	..	..	..	..	×	..
Leucophloeus fenestratus, Ridley	×	..	..	..	×	..	..

Species.	Australia.				Malay area.	Indian Ocean, including Red Sea.	Further distribution.
	North coast.	East coast.	South coast.	West coast.			
ORDER TETRAXONIDA—*cont.*							
SUB-ORDER SIGMATOSCLEROPHORA—*cont.*							
Family AXINELLIDAE—*cont.*							
Ciocalypta penicillus (Bowerbank)	×	×	×	×	×	×	Eastern Atlantic, from N. Europe to S. Africa.
Collocalypta mertoni (Hentschel)	..	..	..	..	×	..	..
Acanthella cavernosa, Dendy	×	..	..	..	..	×	..
Pararhaphoxya, gen. n., *tenuiramosa*, sp. n.	..	..	..	..	..	..	..
Family CLAVULIDAE	..	..	..	..	..	..	..
Pseudosuberites andrewsi, Kirkpatrick	..	..	..	..	×	..	..
Laxosuberites proteus, Hentschel	..	×	×	..	..	×	..
Polymastia megasclera, sp. n.	..	..	..	..	..	..	..
Tethya robusta (Bowerbank)	×	×	×	×	×	×	..
T. japonica, Sollas	..	..	..	..	×	×	..
Tethyorrhaphis oxyaster, sp.n.	..	..	..	..	..	..	..
Timea stellata (Bowerbank)	..	..	..	..	..	..	Europe.
Spirastrella inconstans(Dendy)	..	..	..	..	..	×	..
S. aurivillii, Lindgren	..	..	..	..	×	..	..
S. semilunaris, Lindgren	..	..	..	..	×	..	..
ORDER KERATOSA	..	..	..	..	..	..	..
Family SPONGIIDAE	..	..	..	..	..	..	..
Phyllospongia dendyi, Lendenfeld	..	..	..	×	..	..	..
Carterispongia foliascens (Pallas)	×	×	×	×	×	×	New Zealand (?); Tropical Pacific (?).
C. vermicularis (Lendenfeld)	..	..	..	×	..	..	..
C. clathrata (Carter)	..	×	×	×	..	×	W. Indies.
Spongia officinalis, Linnaeus	?	?	?	?	×	×	W. Indies; Mediterranean.
S. nardorus (Lendenfeld)	×	..	×	..	..	..	..
Thorectopsamma, gen. n., *irregularis*, sp. n.	..	..	..	..	..	..	..
Hircinia irregularis (Poléjaeff)	×	×	..	..	..	..	..
H. echinata, Keller	..	..	..	..	..	×	..
H. ramosa, Keller	..	..	..	..	..	×	..
H. pinna, Hentschel	..	..	..	..	×	..	..
H. ramodigitata, sp. n.	..	..	..	..	..	..	..
H. aruensis, Hentschel	..	..	..	..	×	..	..
H. dendroides (Poléjaeff)	..	×	..	..	×	×	..
Dysidea fragilis (Montagu)	×	×	×	..	×	×	Europe.
D. reticulata (Thiele)	..	..	..	×	×	..	..
D. herbacea (Keller)	..	..	×	..	×	×	..
Family APLYSINIDÆ	..	..	..	..	..	..	..
Luffariella variabilis (Poléjaeff)	..	..	..	..	×	..	..
Aplysina mollis, var. *aruensis*, Hentschel	..	..	..	..	×	..	..
Druinella purpurea (Carter)	×	..	..	×	..	×	..
D. ramosa, Thiele	..	..	..	..	×	..	..
Family APLYSILLIDAE	..	..	..	..	..	..	..
Aplysilla rosea (Barrois)	..	×	..	..	..	..	..
Dendrilla membranosa (Pallas)	×	..	..	..	×	×	Antarctic : S. America.
Basta flabelliformis (Pallas)	×	×	..	×	×	×	Philippines.

SYSTEMATIC NOTES ON THE COLLECTION OBTAINED BY THE GREAT BARRIER REEF EXPEDITION.

ORDER CALCAREA.

Family LEUCASCIDAE.

Genus *Pericharax*, Poléjaeff.

Pericharax heteroraphis (Poléjaeff).

P. carteri, var. *heteroraphis*, Poléjaeff, 1884, p. 66, pl. ii, fig. 5, pl. vii, fig. 8; *P. heteroraphis*, Dendy, 1913, p. 13; *P. peziza*, *idem*, *l. c.*, p. 15, pl. i, fig. 9; pl. v, figs. 3, 4; Burton, 1930, p. 3.

OCCURRENCE.—Stn. XXIV, 13th March, 1929; ¾ mile N.E. of Pasco Reef, 16½ fath., hard and shelly. Stn. XXV, 17th March, 1929: In Papuan Pass, 20–25 fath., foraminifera and shell fragments.

REMARKS.—The holotype of *P. heteroraphis* is a subspherical sponge with a broad rooting attachment. There is an apical oscule, with margins produced into a low collar-like elevation, leading into a spacious gastral cavity with the patent openings of the exhalant canals distributed evenly over the surface. These have an average diameter of 1 mm. and are 1 mm. distant from each other. The outer surface of the sponge is finely porose, in some places smooth to the touch, in others harsh. The harshness is due to the projecting ends of the rays of the large triradiates.

The specimen assigned by Dendy to *P. heteroraphis* is practically globular, with an apical oscule, the margins of which do not extend above the general level of the surface. The surface itself is like that of the type in appearance, but more noticeably glabrous and almost without harshness to the touch. The openings into the cloacal cavity are arranged in irregular groups, situated at varying distances from each other, and have an average diameter of 2 mm.

Of the "Siboga" specimens assigned to this species (Burton, *loc. cit.*) two are like the holotype, but the majority of them have given rise "either by budding or by the coalescence of adjacent individuals . . . to masses of rounded lobes". The surface is entirely glabrous, the oscule without projecting margin and the exhalant openings lining the cloaca arranged as in the type. There is one exception to this, among the "Siboga" sponges, an irregularly lobose sponge, very harsh to the touch, with oscules surrounded by a membranous collar. It differs from all other specimens in that each oscule leads into a shallow cloaca formed by the confluence of several large exhalant canals. The colour in the type is a light greyish-brown; in the "Sealark" specimen, grey; in the typical "Siboga" specimens yellow, strongly tinged with a purplish brown, and in the atypical, lobose specimen referred to, light yellow.

The type of *P. peziza* is a regular cup-shaped sponge, with surface smooth and porose and with the mouth of the cup fringed with the remains of a membranous collar. The inner wall of the cup (*i.e.* the cloacal cavity) is covered with exhalant openings of the same size and distribution as in the type of *P. heteroraphis*. In describing *P. peziza*, Dendy stated that it "is distinguished from *P. heteroraphis* chiefly by its remarkable external form". Actually this external form, regarded by him as of such significance, is merely a simple modification of the typical form, and since the form of the species is now shown to be variable there is no justification for retaining Dendy's name, especially as it can also be shown that the skeleton contains nothing worthy of specific distinction.

The first of the Barrier Reef specimens is incomplete, but evidently had much the same shape as the type of *P. heteroraphis*. It was probably about 4 cm. in diameter (about three times the size of the type) and the openings lining the cloacal cavity are correspondingly larger. The surface is very harsh to the touch, and the colour is a greyish-yellow. The second specimen consists of three coalescent individuals, the cloacal cavities of which have no connection with each other : the larger of these is damaged, but evidently had a similar form to the type of *P. peziza* ; the second is intermediate in form between the largest individual and the type of *P. heteroraphis* ; and the third is small, strongly recalling one of the lobes of the atypical " Siboga " specimen. This specimen proves, if any further proof were needed, that *P. peziza*, the type of *P. heteroraphis* and the atypical (" Siboga ") specimen of the latter species are conspecific. Other features of this same specimen are its dark greyish-brown colour, smooth surface and the tendency of the surface to be thrown into low folds.

The third Barrier Reef specimen is very like the type of *P. heteroraphis* in external form, but has the same colour as the preceding specimen, while the surface folds are more marked. The fourth specimen is the largest yet recorded for the species. It is subspherical, with apical oscule surrounded by a membranous collar, very dark in colour, with smooth surface thrown into pronounced folds or produced into foliate protuberances. So unlike the typical form is it that, but for the intermediates already discussed, it might be thought to represent a new species.

The variation in external form is accompanied by a variability in the size of the spicules, particularly of the large triradiates. Since this is often considerable, a comparative table is given below showing the extent of the variation in these spicules.

Specimen.	Length and diameter, at base, of typical ray of large triradiate.
P. heteroraphis, Poléjaeff. Holotype	2·0 × ·128.
P. heteroraphis, Poléjaeff. Dendy, 1916	1·55 × ·1.
P. peziza, Dendy. Holotype	1·4 × ·07.
P. heteroraphis, Poléjaeff. Burton, 1930 :	
Specimen *a*	1·3 × ·13
,, *b*	·98 × ·075
,, *c*	1·1 × ·11
,, *d*	1·3 × ·13.
,, *e*	·48 × ·035.*
,, *f*	·5 × ·044.*
,, *g*	·96 × ·112.
P. heteroraphis. Barrier Reef :	
Specimen 1	1·44 × ·192.
,, 2	1·28 × ·096.
,, 3	1·28 × ·112.
,, 4	1·44 × ·096.

Distribution.—Malay area ; Indian Ocean ; Tristan da Cunha.

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* Despite differences in the size of the spicules, these specimens are similar to others with more normal spiculation in all other respects.

Family SYCETTIDAE.

Genus *Sycon*, Risso.

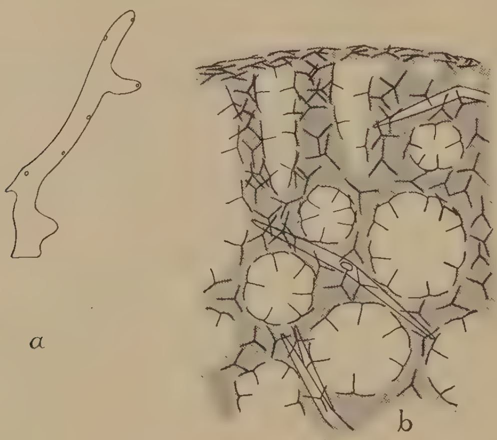
Sycon gelatinosum (Blainville).

Alcyoncellum gelatinosum, Blainville, 1834, p. 529, pl. xcii, fig. 5 ; Gray, 1867, p. 557 ; *Sycidium gelatinosum*, Haeckel, 1869, p. 245 ; *Grantia gelatinosa*, Bowerbank, 1869, p. 84 ; *Sycandra arborea* (= *Sycodrendron arboreum*), Haeckel, 1872, p. 331, pl. liii, fig. 1 ; pl. lviii, fig. 7 ; *S. alcyoncellum* (= *Sycothamnus alcyoncellum*) et varr. *gelatinosa*, *virgultosa*, Haeckel, *l. c.*, p. 333, pl. liii, fig. 2 ; pl. lviii, fig. 5 ; *Sycon gelatinosum*, Dendy, 1892, p. 83 ; Dendy and Row, 1913, p. 746 ; Dendy and Frederick, 1924, p. 483.

OCCURRENCE.—Low Isles, 9th March, 1929.

REMARKS.—A particularly robust colony, 3 cm. high.

DISTRIBUTION.—Java ; Australia (east, south and west coasts).



TEXT-FIG. 1.—*Leuconia ramosa*, sp. n., showing *a*, external form (× ⅔), and *b*, the skeleton, from a section at right angles to surface.

Family HETEROPHIDAE.

Genus *Leuconia*, Grant.

Leuconia ramosa, sp. n. (Text-fig. 1.)

HOLOTYPE.—B.M. 30.8.13.3.

OCCURRENCE.—Stn. XXIV, 13th March, 1929 : ¾ mile N.E. of Pasco Reef, 16½ fath., hard and shelly.

DIAGNOSIS.—Sponge composed of cylindrical branches growing more or less erect, and tunnelled by numerous longitudinal canals ; surface smooth, even, minutely reticulate ; oscules, leading into shallow cloacae 1–3 mm. in diameter, situated at various points on branches ; colour, in spirit, pale greyish-brown ; dermal skeleton of regular triradiates, arranged tangentially, variable in size, each ray measuring up to ·22 × ·011 mm. ; skeleton of chamber layer confused, formed by small triradiates, slightly sagittal, with basal ray up to ·24 × ·012 mm., and large regular triradiates irregularly but sparsely distributed,

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with rays measuring up to ·96 × ·064 mm.; quadriradiates lining large canals of similar dimensions to small triradiates of chamber layer.

REMARKS.—The species is peculiar, among those species of *Leuconia* devoid of oxea, in its ramose form.

ORDER TETRAXONIDA.

Suborder HOMOSCLEROPHORA.

Family PLAKINIDAE.

Genus *Corticium*, Schmidt.

Corticium candelabrum, Schmidt.

C. candelabrum, Schmidt, 1862, p. 42, pl. iii, fig. 25; Lendenfeld, 1903, p. 122; Babić, 1922, p. 292.

OCCURRENCE.—Stn. X, 22nd January, 1929: Satellite Reef, 14–17 fath., coral, shell, gravel, and mud.

DISTRIBUTION.—Malay Area; Mediterranean.

Genus *Oscarella*, Schulze.

Oscarella tenuis, Hentschel.

O. tenuis, Hentschel, 1909, p. 351, pl. xxiii, figs. 9, 12.

OCCURRENCE.—Stn. XII, 24th February, 1929: Penguin Channel, 10–15½ fath., mud and rock.

REMARKS.—Incrustations on the Polyzoa *Microporella mutabilis*, Hastings.

DISTRIBUTION.—S.W. Australia.

Suborder ASTROSCLEROPHORA.

Family STELLETTIDAE.

Genus *Stelletta*, Schmidt.

Stelletta purpurea, Ridley.

S. purpurea, Ridley, 1884, p. 473, pl. xl, fig. E; pl. xliii, fig. j; Burton, 1926, p. 44; *idem*, 1930, p. 415.

OCCURRENCE.—Reef Crest, Yonge Reef, Outer Barrier, 5th June, 1929.

DISTRIBUTION.—Australia (north and east coasts); Malay Area; Indian Ocean; New Zealand; Antarctic.

Stelletta clavosa, Ridley.

S. clavosa, Ridley, 1884, p. 474, pl. xliii, fig. i ; Lendenfeld, 1906, p. 287 ; Hentschel, 1912, p. 310

Occurrence.—Stn. XVI, 9th March, 1929 : About ½ mile W. of N. Direction Is., 20 fath., stony. Stn. XIX, 10th March, 1929 : ½ mile N. of Eagle Is., 10 fath., shell and gravel.

Distribution.—Australia (north and west coasts) ; Malay Area ; Indian Ocean (from Ceylon eastwards).

Genus *Ancorina*, Schmidt.

Ancorina agglutinans, Thiele.

Ecionema agglutinans, Thiele, 1899, p. 7, pl. iv, fig. 1 ; pl. v, fig. 2.

Occurrence.—General Survey (no other information available).

Remarks.—The single specimen agrees closely with the holotype except that the microrhabds and asters are slightly larger, the asters being ·014 mm. in diameter as against ·01 mm. in the holotype.

Distribution.—Malay Area.

Genus *Jaspis*, Gray.

Jaspis stellifera (Carter).

(For synonymy and discussion see Shaw, 1927, p. 422.)

Occurrence.—Low Isles ; the Thalamita Flat.

Distribution.—Australia (north and south coasts).

Family CHONDROSIIDAE.

Genus *Chondrilla*, Schmidt.

Chondrilla nucula, Schmidt.

C. nucula, Schmidt, 1862, p. 39, pl. iii, fig. 22 ; Annandale, 1915, p. 470 ; Burton, 1924, p. 206 ; Dendy, 1924, p. 314.

Occurrence.—Low Isles ; the Thalamita Flat, 4th April, 1929.

Distribution.—New Zealand ; Australia (east and north coasts) ; Malay Area ; Indian Ocean ; West Indies ; Azores ; Mediterranean.

Chondrilla australiensis, Carter.

C. australiensis, Carter, 1873, p. 23, pl. i, figs. 10–14, 16 ; Burton, 1924, p. 207.

Occurrence.—Stn. XXIII, 12th March, 1929 : In lee of Turtle Is., 8 fath., mud and shell.

Distribution.—Australia (east coast) ; Malay Area ; Indian Ocean.

Suborder SIGMATOSCLEROPHORA.

Family Tetillidae.

Genus *Cinachyra*, Sollas.

Cinachyra, Sollas. 1886, p. 183; *Cinachyrella*, Wilson, 1925, p. 356.

Wilson (*loc. cit.*) proposed to subdivide those Tetillidae with porocalices into two subgenera, *Cinachyra* and *Cinachyrella*, having the same relation to each other as *Craniella* to *Tetilla*, the one having a stout cortical palisade of oxea, the other an ill-defined palisade or none at all; but just as it is not possible, or necessary, to separate *Tetilla* and *Craniella*, so I believe it to be unnecessary and, probably, impossible to separate *Cinachyra* and *Cinachyrella*.

Cinachyra australiensis (Carter).*

Tethya cranium, var. *australiensis*, Carter, 1886, p. 127; *Tetilla ? australiensis*, Sollas, 1888, p. 43; *Spiretta raphidiophora*, Lendenfeld, 1888, p. 43; *S. porosa, idem, l. c., p.* 43; *Cinachyra schulzei*, Keller, 1891, p. 337, pl. xix, figs. 41–43; *C. trochiformis, idem, l. c.*, p. 340, pl. xix, figs. 44, 45; *Tetilla ternatensis*, Kieschnick, 1896, p. 527; *T. schulzei, idem, l. c.*, p. 21; *idem*, 1900, p. 562, pl. xlv, figs. 16–22; *T. ternatensis*, Lindgren, 1898, p. 329, pl. xvii, fig. 14, pl. xix, fig. 25; *T. australiensis*, Thiele, 1899, p. 6, pl. i, fig. 1; pl. v, fig. 5; *T. ternatensis*, Kirkpatrick, 1900, p. 132; *Cinachyra malaccensis*, Sollas (Miss), 1902, p. 219, pl. xiv, fig. 2, pl. xv, fig. 5; *Tetilla lindgreni*, Lendenfeld, 1903, p. 18; *T. australiensis, idem, l. c.*, p. 20; *T. porosa, idem, l. c.*, p. 22; *T. poculifera*, Dendy, 1905, p. 90, pl. i, fig. 3, pl. vi, fig. 4; *Tethya hebes*, Lendenfeld, 1906, p. 98, pl. xvi, figs. 19–38; *Cinachyra isis, idem, l. c.*, p. 143, pl. xv, figs. 54–58; pl. xvi, figs. 1–4; *C. alba-tridens, idem, l. c.*, p. 149; pl. xv, figs. 7–9; *C. alba-bidens, idem, l. c.*, p. 151, pl. xvi, figs. 39–44; *C. alba-obtusa, idem, l. c.*, p. 154, pl. xvi, figs. 45–52; *Tetilla cinachyroides*, Hentschel, 1911, p. 281, fig. 1; *T. poculifera*, Row, 1911, p. 306; *Chrotella ibis*, Row, 1911, p. 311, pl. xxxv, fig. 2, pl. xxxvi, fig. 7; *Tethya clavigera*, Hentschel, 1912, p. 327, pl. xvi, fig. 1; pl. xviii, fig. 10; *Cinachyra mertoni, idem, l. c.* p. 332, pl. xiii, fig. 1; pl. xviii, fig. 12; *C. nuda, idem, l. c.*, p. 333, pl. xiii, fig. 2; pl. xviii, fig. 13; *C. vaccinata*, Dendy, 1921, p. 14; pl. i, fig. 4; pl. ii, fig. 1; *C. isis, idem, l. c.*, p. 16, pl. x, fig. 3; *C. providentiæ, idem, l. c.*, p. 18, pl. i, fig. 5, pl. x, fig. 2; *Tetilla* (*Cinachyrella*) *clavigera*, Wilson, 1925, p. 365, pl. xxxix, fig. 4; *T.* (*Cinachyrella*) *paterifera, idem, l. c.*, p. 375, pl. xxxix, figs. 6, 8; pl. xlviii, fig. 4.

Occurrence.—Low Isles; the Thalamita Flat; east of Sand Flat; the Middle Moat; the Mangrove Park; Batt Reef.

Diagnosis.—Sponge more or less spherical, the outer surface usually coated with a layer of sand; oscules small and inconspicuous, porocalices usually small and scattered over the surface; skeleton composed of radial bundles of oxea which tend to spread out in divergent brushes at the surface; anatriaenes or protriaenes may be present in small quantities. Microscleres, microxea, which may be sometimes absent, and sigmaspirae.

Remarks.—A large number of specimens of *Cinachyra* have been recorded from the Indo-Pacific under a variety of generic and specific names, but the majority of these are so much alike that a doubt arises as to the validity of these distinctions.

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* Uliczka (1929, pp. 38–46) has recently described a group of species of *Cinachyra*, *C. rhizophyta*, *C. alloclada*, *C. apion*, *C. kükenthali*, *C. schistospiculosa*, from the West Indies which appear to be indistinguishable from *C. australiensis*. These have the same characters and range of variation as *C. australiensis*, as here understood, and there can be little doubt that they are synonyms of Carter's species.

The majority of the known individuals of *Cinachyra* from the Indo-Pacific may be divided into three groups, which may be called provisionally the *australiensis*-, *schulzei*- and *porosa*-groups respectively. The members of each of these are very similar in general characters and, after due allowance is made for the normal fluctuating variations in both the external form and in the details of spiculation, it is found that they may be distinguished in the following way only: the *australiensis*-group is characterized by the possession of roughened microxea; the *schulzei*-group has smooth microxea; and the *porosa*-group is without microxea. Before proceeding with the discussion of the taxonomic value of these particular characters, it will be necessary to consider in turn each of the three groups and the members of which it is composed.

The type of *Tethya cranium*, var. *australiensis*, Carter, from which the first group takes its name, is preserved in the dried state and is therefore in an unsatisfactory condition for examination. That it is a true *Cinachyra* is certain, but the porocalices, having collapsed on drying, have been mistaken for oscules. The skeleton consists of oxea, 5·0 by ·038 mm., anatriaenes, with cladi ·135 mm. long, roughened microxea, ·12 mm. long, and sigmaspirae, ·017 mm. chord. Complete protriaenes cannot be found in the preparations so far made, but there can be little doubt that they are, or were, present. The many slender rhabds terminating in a broken end a little beyond the surface almost certainly represent the shafts of the protriaenes, the cladi probably having been broken off by abrasion of the surface. The microxea, which are very abundant, were described by Sollas as " minutely-spined ", but in effect their surfaces are only roughened, and to so slight a degree as to be barely perceptible.

Spiretta raphidiophora, Lendenfeld, is described as spherical and the dimensions of the spicules are practically identical with those of *Tethya cranium*, var. *australiensis*. The protriaenes cannot be found, and the microxea are faintly roughened and very abundant. Porocalices are present in the small fragment of the type preserved in the British Museum, but, as in the preceding specimen, their walls have collapsed so that the openings are inconspicuous. There can be no doubt therefore of the identity of this species with *Tethya cranium*, var. *australiensis*.

Tetilla australiensis (Carter), Thiele, bears clear indications of the presence of porocalices (see Thiele, 1899, pl. i, fig. 1) and the spiculation differs little from that of the holotype. The oxea are shorter, only 4·0 mm. long and antriaenes are absent. Protriaenes are present, with cladi ·15 mm. long. No doubt, as in the case of the protriaenes of the holotype, anatriaenes would be found if more careful search were made.

Tetilla schulzei, Kieschnick, an obvious *Cinachyra*, has a spiculation identical in all respects with that of *Tethya cranium*, var. *australiensis*, except that protriaenes, identical with those of *Tetilla australiensis* (Carter), Thiele, are present.

Tetilla ternatensis, Kieschnick, was inadequately described, but, even so, there is justification for regarding it as identical with *Tethya cranium*, var. *australiensis*, but the specimens described under the same name by Lindgren and Kirkpatrick, and re-named *Tetilla lindgreni* by Lendenfeld, are identical with *T. schulzei*, Kieschnick.

The type of *T. poculifera*, also an undoubted *Cinachyra*, differs slightly from the specimens already discussed in that the megascleres are all slightly smaller. There are present also some curious plagiotriaenes, but as these are absent in the co-types, which agree with the holotype in all other respects, they can only be regarded as teratological modifications of the normal protriaenes. The fact that the megascleres are slightly smaller does not constitute a specific distinction and *T. poculifera* must take its place with the other specimens already discussed.

Tethya hebes, Lendenfeld, agrees almost exactly with *T. cranium*, var. *australiensis*, in external features, structure of skeleton and dimensions of spicules. It has, on the other hand, a few plagiotriaenes, such as are found in *Tetilla poculifera.*

Tetilla cinachyroides, Hentschel, was described from a fragment of sponge, but the original description shows that that piece had all the characters of *T. poculifera*, Dendy, except the porocalices, but these must almost certainly have been present on the missing portion of the sponge.

The great similarity between the specimens discussed above makes it impossible to regard them as representative of more than one species. Indeed, it is difficult to imagine why their identity with a single species should have escaped notice for so long a time.

The next group begins with *Cinachyra schulzei*, Keller. This appears to differ from the holotype of *Tetilla poculifera*, included in the *australiensis*-group, in the more conspicuous porocalices, in the presence of smooth microxea and microspheres, the latter being comparable with the silica-pearls of *Cinachyra barbata*, Sollas, enigmatic bodies having no taxonomic value. *C. trochiformis*, Keller, is very like *C. schulzei*, but differs in the absence of microspheres and in the distribution of the porocalices, which, instead of being generally distributed over the surface as in *C. schulzei*, are confined to a belt running round the lower part of the sponge.

C. isis, Lendenfeld, has the same form as *C. schulzei*, but its spicules are slightly larger, agreeing therein with those of *Tethya cranium*, var. *australiensis*. The plagiotriaenes are present, but not the microspheres. In fact, the only real difference between this species and *Tethya hebes* of the *australiensis*-group, rests in its having smooth, instead of roughened, microxea.

C. alba-tridens, Lendenfeld, agrees with the co-types of *T. poculifera*, except that the microxea are so rare that they readily escape detection. Lendenfeld makes no mention of the microxea, but in his preparations from the type they may be found in very small quantities.

Chrotella ibis, Row, is like *Cinachyra isis*, Lendenfeld, but differs in the presence of abnormal triaenes, and in having a comparatively smooth instead of a hirsute surface, which, as I have shown (Burton, 1931), is not unusual in such sponges and is probably due to a periodic extrusion of spicules.

Cinachyra mertoni, Hentschel, is almost identical with *C. alba-tridens*, Lendenfeld, while *C. nuda*, Hentschel, differs from both only in the absence of anatriaenes and in having a smooth surface as in *Chrotella ibis*, Row.

Of the two species of *Cinachyra* described by Dendy from the Indian Ocean, the first, *C. vaccinata*, is remarkable for its large porocalices,* and the second, *C. providentiae*, is practically indistinguishable from *C. alba-tridens*, Lendenfeld. Finally, *Tetilla paterifera*, Wilson, is obviously identical with *Cinachyra vaccinata*, Dendy, while the peculiar distribution of the porocalices in *C. trochiformis*, Keller, though interesting from other points of view, can have no taxonomic significance.

To summarize, the *schulzei*-group consists of a number of so-called species showing the same general characteristics and the same variations as the members of the

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* At least, in the holotype, though in the paratypes the porocalices are more like those found in members of the *australiensis*-group.

australiensis-group. The only possible distinction that can be made between the *australiensis*-group and the *schulzei*-group lies therefore in the character of the microxea, whether they be rough or smooth, and to maintain a distinction on such grounds is out of the question. In the most roughened microxea of the *australiensis*-group, the roughening is only perceptible by careful examination with a high power of the microscope, and there can be no doubt at all that examination with sufficiently high magnification of a number of specimens would show all transitions from the rough to the smooth. Indeed, had not previous authors tended to stress this character, it would not have been considered worthy of more than passing mention here. There can be, then, no real distinction between the two groups, and their constituent species must all be considered synonymous with *Cinachyra australiensis* (Carter).

The identity with a single species of the many forms discussed above is more strikingly evident when the specimens are examined side by side than can be demonstrated by words and figures. The position of the *porosa*-group is, however, a matter of opinion. This group includes *Spiretta porosa*, Lendenfeld, *Cinachyra malaccensis*, Sollas, *C. alba-bidens*, Lendenfeld, *C. alba-obtusa*, Lendenfeld, and *Tethya clavigera*, Hentschel. Disregarding the minute details on which these various species were founded, we have here a group of sponges having the same essential characters as *C. australiensis* (Carter), as now understood; the same globular or subglobular form, radial bundles of oxea diverging just below the surface to form dermal brushes of projecting oxea; anatriaenes and protriaenes associated with radial bundles; and the same sigmaspirae. But in no case have microxea been found. At the same time, mention has been made already of a specimen of *C. alba-tridens* in which, though present, these spicules were extremely rare, and there is no reason to suppose that other intermediates may not be found. There is, therefore, considerable justification for regarding the *porosa*-group as a collection of specimens of *C. australiensis* (Carter) which have lost their microxea.

DISTRIBUTION.—Australia; Malay Area; Indian Ocean.

Genus *Raphidotethya*, gen. n.

GENOTYPE.—*R. enigmatica*, sp. n.

DIAGNOSIS.—Tetillidae with skeleton composed of well-defined fasciated systems of loose bundles of oxea radiating from a central nucleus; distal ends of radial systems spreading out slightly near surface, with outermost spicules projecting beyond; associated with distal ends of radial systems are smaller oxea set also at right angles to surface; small oxea, similar to those found at surface, scattered sparsely in inner tissues; triaenes absent; cortex not recognizable; microscleres sigmaspirae and raphides, each divided into two categories.

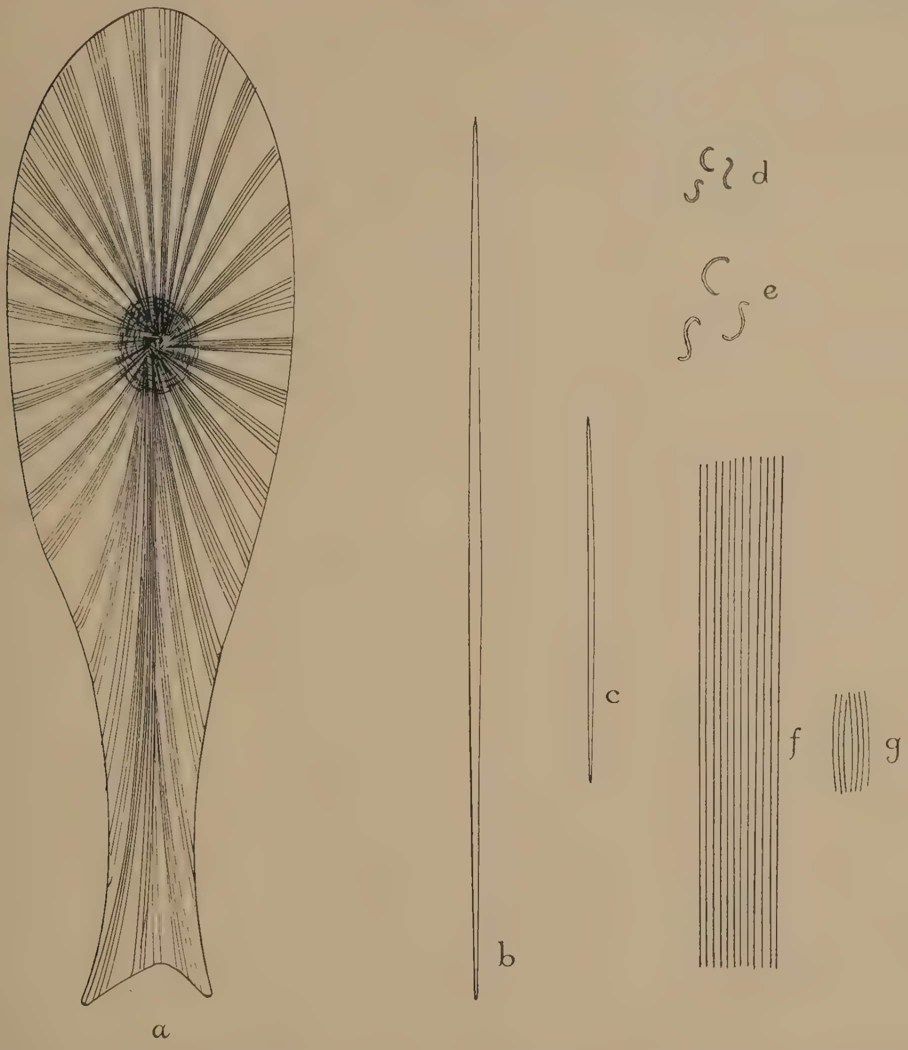
REMARKS.—The genus is closely allied to *Amphitethya*, from which it differs mainly in the absence of triaenes.

Raphidotethya enigmatica, sp. n. (Text-fig. 2.)

HOLOTYPE.—B.M. 30.8.13.27.

OCCURRENCE.—Stn. XVI, 9th March, 1929: $\frac{1}{4}$ mile N. of N. Direction Is., 19 fath., sand.

DIAGNOSIS.—Sponge ficiform, stipitate ; surface even, slightly hispid ; texture firm and fleshy ; oscules and pores not apparent ; oxea of main skeleton straight, smooth, measuring 1·4 by ·024 mm. ; smaller oxea, associated with distal ends of radial systems of main skeleton, straight and smooth, measuring ·73 by ·012 mm. ; sigmaspirae of two sizes, ·024 and ·009 mm. long respectively ; raphides, in bundles, of two sizes, ·03 and ·15 mm. long, respecitvely.



TEXT-FIG. 2.—*Raphidotethya enigmatica*, sp. n. *a*, Longitudinal section of whole sponge to show arrangement of main skeleton, × 2 ; *b* and *c*, large and small oxea, × 100 ; *d* and *e*, sigmaspiræ of two sizes, *f* and *g*, raphides of two sizes, × 300.

REMARKS. The holotype is 4½ cm. high and 2 cm. in diameter at the widest point, just below the apex. Its shape recalls that of the species of *Amphitethya*, a closely-allied genus, in which the main skeleton has essentially the same structure, but which possesses amphitriaenes in addition to oxea. The sigmaspirae are of typical form.

Family HAPLOSCLERIDAE.

In dealing with the Haplosceridae of this report, special emphasis is laid on the utility of dermal skeleton as a guide to identification. In my experience the characters of the dermal skeleton, when present, and the presence or absence of a special dermal skeleton are features which have not been accorded their due significance. It is probable, judging from the preparations in the British Museum collections, that the common practice in identifying specimens is to cut two sections, one at right angles and the other tangentially to the surface, but it is quite certain that too little significance has been attached to the characters of the dermis as seen in tangential section. In the case of the Chalininae, we have two well-marked groups ; the first characterized by a soft texture and a pale-coloured spongin, and the second by a coarse, firm texture and dark-coloured spongin. Both the texture and the colour of the spongin are relative properties, transitions between the two groups in respect of these characters are often found, and well-marked exceptions to this generalization could be cited. Speaking generally the members of the first group are cosmopolitan, but more commonly found perhaps in temperate waters, the members of the second being almost exclusively confined to tropical or sub-tropical seas. But none of these features, texture, colour or distribution, is sufficiently constant to be used as a taxonomic guide. On the other hand, the first group is characterized by the complete absence of a special dermal skeleton (as in *Haliclona*) or by the presence of a tangential unispicular skeleton (as in *Adocia*). The second group is characterized by a stout dermal reticulation of spiculo-fibre (as in *Callyspongia*). In the character of the dermis we have then the only certain indication of a generic distinction.

In my preliminary examination of specimens of Haplosceridae I have often been misled by the appearance of tangential sections. For example, in a specimen of *Haliclona*, if the secondary fibres of the main skeleton lie just beneath the dermis, as they sometimes do, a tangential section will appear to contain a special dermal reticulation of the *Callyspongia*-type. In other cases, such as a specimen of *Callyspongia* with a feebly-developed dermal skeleton, the radial section gives the impression that a special dermal skeleton is absent. I have, therefore, found it necessary, in some cases, to examine the surface of a specimen first with a hand-lens, then with a low-power binocular microscope, and finally by means of a mounted tangential section. By using these three magnifications it is practically impossible to go wrong. Another very good criterion, but one which comes of experience, is the feel of the knife-edge as the section is cut, and the appearance of the surface after the cut is made. In fact, with a little experience, it is possible to forecast correctly in about 95 per cent. of the specimens examined from the mere act of cutting the tangential section.

I believe that the only hope of classifying the Haplosceridae satisfactorily is to pay as much, if not more, attention to the dermal skeleton as to the main skeleton. And I believe further that similar treatment applied to other groups will prove a great help. For example, the genus *Topsentia* contains a number of species the spiculation of which is made up of oxea of various sizes ; to that extent they all appear congeneric and to form a natural group. But it is certain that they represent several genera, since the disposition of these spicules differs considerably particularly in the dermis, and I have found from experience that it is practically impossible to recognize or to distinguish between these species without first finding out the characters of the dermal skeleton.

Genus *Haliclona*, Grant.

Haliclona, Grant, 1841, p. 5; *Chalina*, Grant, 1861, p. 76; *Diplodemia*, Bowerbank, 1864, p. 201; *Prianos*, Gray, 1867, p. 520; *Philotia, idem, l. c.*, p. 522; *Gellius, idem, l. c.*, p. 538; *Orina, idem, l. c.*, p. 539; *Chalinula*, Keller, 1879, p. 318; *Acervochalina*, Ridley, 1884, p. 398; *Phylosiphonia*, Lendenfeld, 1887, p. 796; *Euchalinopsis, idem, l. c.*, p. 815; *Chalinodendron, idem, l. c.*, p. 819; *Chalinorhaphis, idem, l. c.*, p. 821; *Polysiphonia*, Levinsen, 1887, p. 512.

Genotype.—*Spongia oculata*, Pallas, 1766, p. 390.

Diagnosis.—Haplosceleridae with skeleton composed of short oxea arranged typically in an isodictyal network of ascending primary fibres and short connecting secondary fibres; fibres may be unispicular or multispicular, with spongin at ends of spicules only or forming a thick investment to whole spicular skeleton; special dermal skeleton absent; surface of sponge rendered hispid from projecting ends of primary fibres; microscleres when present, sigmata, toxa or trichodragmata.

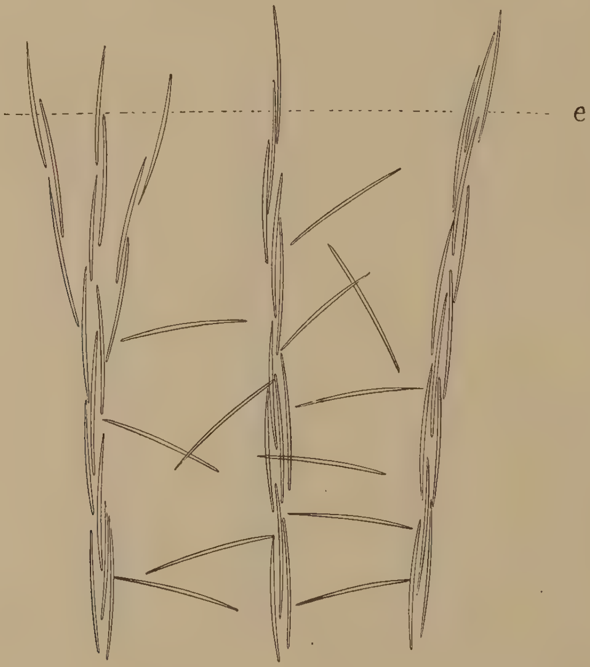
Remarks.—The genus *Haliclona* was first mentioned by Grant (1841, p. 5, fig. 2) in describing the anatomy and physiology of a species he called *Haliclona occulata* (*sic*). From his figure this sponge is clearly the *Spongia oculata* of Pallas, known since the days of Bowerbank as *Chalina oculata* (Pallas). *Haliclona* must therefore replace *Chalina*, a name first used by Grant (1861, p. 76), without diagnosis or genotype, and later adopted by Bowerbank (1864, p. 208) with *Halichondria oculata* (Pallas) Johnston as type. Of *Diplodemia*, Bowerbank (1864, p. 201), with genotype *D. vesicula*, Bowerbank (*loc. cit.* p. 202, figs. 234, 273, 377), it is impossible to say anything with certainty, but the probability is that the type comprises the remains of a *Haliclona* sp., possibly *H. oculata* (Pallas), left on a shell after the main mass of the sponge had been torn away. The genus *Philotia*, Gray (1867, p. 522), has for genotype *Isodictya varians*, Bowerbank (1864, p. 278, fig. 309), the holotype of which is an obvious example of *Haliclona oculata* (Pallas). Finally, *Euchalinopsis*, Lendenfeld (1887, p. 815) must also be regarded as a synonym of *Haliclona*. Lendenfeld named no genotype and the first species mentioned by him is *Chalina oculata* (Pallas). This species is accordingly accepted here as the genolectotype of the genus.

In addition to the genera so far discussed it is necessary to consider the relation of *Acervochalina* to *Haliclona*. *Acervochalina* was established by Ridley (1884, p. 398), for *Chalina limbata*, Bowerbank, with the following diagnosis:

> "Massive, sessile Chalinidae. Fibre strongly ceratinous, containing axially or diffusely arranged slender acerate spicules, which do not exceed in bulk the horny material of the fibre which contains them. Vents distinct, ranged along upper surface."

According to this diagnosis the only essential difference between *Haliclona* and *Acervochalina* concerns the external form, which is wholly insufficient for a generic distinction, and since the structure of the skeleton differs hardly at all in the two cases, there is no reason for maintaining the distinction between the two genera. There is one other point that need be considered, if only because it offers a possible explanation of the reluctance on the part of some authors to abandon the use of the name *Acervochalina*. *Chalina limbata* is known to secrete quantities of mucilage in life and, as a consequence, presents a different appearance to *Haliclona oculata* and other typical species of *Haliclona*. The same may, however, be said of *Myxilla incrustans* as compared with other species of *Myxilla*, or *Tedania mucosa* and other species of *Tedania*. In fact, examples of this kind may be found in many genera. If we are to regard such secretion as a basis for generic distinction, then it will be necessary to subdivide very many other genera too on the same grounds. To do so would, however, be little less than ludicrous. *Acervochalina* must, therefore, be regarded as a synonym of *Haliclona*, and with it *Chalinodendron*, Lendenfeld (*loc. cit.*, p. 819), with genolectotype *Chalina gracilenta*, Bowerbank (1866, p. 372), (= *C. limbata*, Bowerbank).

So far *Haliclona* (= *Chalina*, Auctt.) has been used to include only those species without microscleres, but there is no reason why species, with sigmata, toxa or trichodragmata, provided they agree in other respects, should not be included. The liability on the part of sponges to undergo reduction in the matter of microscleres is sufficiently well-known to call for much comment here, except to point out that greater convenience will result by extending the diagnosis of *Haliclona* to include all species with a chalinoid skeleton irrespective of the presence or absence of sigmata, toxa or trichodragmata. In this case, it will be necessary to include the genus *Gellius*, Gray (1867, p. 538), since the genotype, *Isodictya jugosa*, Bowerbank (1866, p. 296), has a typically chalinoid skeleton but, in addition, microscleres in the form of sigmata (see Text-fig. 3).*



TEXT-FIG. 3.—*Gellius jugosus* (Bowerbank). Section at right angles to surface, to show arrangement of skeleton. From holotype. *e* = ectosome.

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* Genus *Gellius*, Gray, 1867, p. 538.

GENOTYPE.—*Isodictya jugosa*, Bowerbank.

GENOHOLOTYPE.—B.M. 10.1.1.294 (for description and illustration see Bowerbank, 1866, p. 296, 1874, pl. i, figs. 11–14).

DIAGNOSIS.—Haplosceridae with sub-isodictyal skeleton of oxea, with multispicular ascending fibres joined at intervals by irregularly scattered single spicules; distal ends of ascending fibres projecting slightly beyond ectosome; no special dermal skeleton; microscleres, when present, sigmata.

DISCUSSION.—The holotype is a small incrustation on a calcareous nodule, and is preserved in the dried state, which makes the determination of its spicular characters difficult. It seems certain, however, The genus *Phylosiphonia*, Lendenfeld (1887, p. 796), was established for *Chalinula fertilis*, Keller (1879, p. 318), and this species is here accepted as the genotype. According to Keller's description and figures, this is a typical *Haliclona*, but without examination of the type-specimen this cannot be stated definitely. The fact remains, however, that a specimen in the British Museum collection, obtained by Norman from the type-locality and agreeing closely with Keller's description of *Chalinula fertilis*, is quite definitely a *Haliclona*.

From a specimen of *Polysiphonia mucronata*, Levinsen, in the British Museum, presumably one of the co-types, it is clear that the species is a typical *Haliclona*.

Haliclona camerata (Ridley).

Reniera camerata, Ridley, 1884, p. 605, pl. liii, fig. H; pl. liv, fig. n; Topsent, 1897, p. 474; Dendy, 1921, p. 31.

Occurrence.—Low Isles, the Thalamita Flat, 20th April, 1929.

Remarks.—The first specimen, though possessing the external form typical of the species, differs slightly from the specimens hitherto recorded in the structure of its skeleton. This is a unispicular reticulation of triangular mesh, in which the component oxea measure ·16 by ·005 mm. In the holotype the oxea are ·2 mm. long and the skeleton an irregularly polygonal network of loosely-knit, multispicular fibres. The specimen described by Dendy (*loc. cit.*) has oxea measuring ·22 mm. long arranged in an irregular reticulation of unispicular and triangular mesh. There is yet another specimen in the British Museum, B.M. 27.2.14.8, with skeleton similar to that of Dendy's specimen, but having oxea measuring ·32 by ·02 mm., and this corresponds closely in spiculation with the second Barrier Reef specimen in which the oxea are ·28 by ·008 mm.

The series of specimens discussed above has a special significance. The external form is so characteristic that there can be no possibility of mistaken identity and we can be sure, therefore, as is so seldom the case in the genus *Haliclona*, that all the specimens so far assigned to the species are conspecific. Yet in these specimens the oxea vary from ·16 to ·32 mm. long and ·005 to ·02 mm. thick, and the skeleton itself varies from unispicular to multispicular with triangular or polygonal meshes. The data thus afforded are of great importance in the biometrical study of the spicules of the Chalininae.

Distribution.—Malay Area; Indian Ocean.

Haliclona reticulata (Lendenfeld). (Plate I, fig. 14.)

Euchalinopsis reticulata, Lendenfeld, 1887, p. 815.

Occurrence.—Stn. XIX, 10th March, 1929: ½ mile N. of Eagle Is., 10 fath., shell gravel.

Remarks.—The single specimen, which seems to resemble the holotype, is a roughly spherical mass, 6 cm. in diameter, of anastomosing trabeculae which bear on their outer margins occasional aculeate processes (Plate I, fig. 14). The surface is finely hispid, and almost conulose in parts. The colour, in spirit, is a greyish yellow. The skeleton is

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as the result of exhaustive examination, that the main skeleton is a sub-isodictyal réticulation such as is shown in Text-fig. 3, although this condition is not realized at every point of the surface. From this it is clear that *Gellius* embodies the characteristics of what has hitherto been regarded as the "*Reniera*"-type of skeleton, and is, apart from the presence of sigmata, identical with *Haliclona*.

an irregular reticulation of spongin fibres cored by spicules measuring ·12 by ·003 mm. The spicules are not markedly strongylote, and occasionally stylote or even oxeote. The dimensions of the fibres are very much the same as those given for the holotype.

The original description of this species is somewhat inadequate and the holotype appears to be lost, or, at least, not immediately available, but the external form is so peculiar for a species of Chalininae that there would appear to be little doubt as to the identification of this specimen with that described by Lendenfeld. So far as the skeleton is concerned there is little to choose between the present specimen of *Haliclona reticulata* and the holotype of *Chalina obtusispiculifera*, Dendy, from Ceylon, while *C. cymaeformis* (Lamarck), also from Ceylon, differs only in slight details of external form. Possibly these three species may eventually be regarded as synonymous.

Distribution.—Australia (Port Jackson); Ceylon (?).

Haliclona clathrata (Dendy).

Reniera clathrata, Dendy, 1895, p. 237; *R.* spec. 6 Sollas (Miss), 1902, p. 211; *R.* spec. 4 Hentschel, 1912 p. 410; *R. clathrata*, Brøndsted, 1923, p. 125.

Occurrence.—Low Isles, Luana Creek, Luana Harbour.

Remarks.—The single specimen is very fragmentary and macerated, but appears at one time to have comprised a sponge of similar form to the holotype of *Reniera clathrata*, Dendy. In places it is massively encrusting, with oscules 3 to 4 mm. in diameter. In other places long slender processes, cylindrical in form, are given off, which may anastomose and bear, at intervals, curious tubular outgrowths, probably corresponding to similar processes in *Reniera* spec. 4 of Hentschel and referred to by that author as resembling " Schneckenfühler ". The skeleton is a unispicular mesh, mainly triangular, through which short polyspicular fibres run at intervals. These fibres appear to be quite independent of the rest of the skeleton. The spicules are oxea measuring ·12 by ·005 mm.

The present specimen appears to be, so far as may be judged by the written descriptions, identical with Hentschel's *Reniera* spec. 4, and Sollas' *R.* spec. 6. It agrees, on the other hand, with the holotype of *Reniera clathrata*, Dendy, with which a direct comparison has been possible, in all respects but the size of the spicules and the unispicular character of the main skeleton. In that specimen the meshes of the main skeleton are mainly polygonal and bispicular, while the independent polyspicular bundles, though present, are feebly developed. In Brøndsted's specimen of *R. clathrata*, Dendy, from Campbell Is., which I have been able to compare with the holotype, the polyspicular bundles are wholly absent. For the rest there is very close agreement between the two in all respects. From such evidence as this it appears to be a debatable question how far the presence of independent polyspicular bundles may constitute an acceptable basis for specific distinction.

Distribution.—Australia (south coast); New Zealand; Malay Area.

Haliclona exigua (Kirkpatrick).

Petrosia exigua, Kirkpatrick, 1900, p. 139, pl. xii, fig. 7; pl. xiii, fig. 4.

Occurrence.—Batt Reef (or Low Isles ?); Three Isles.

Remarks.—The two specimens are typical except that the oxea measure ·16 by ·008 mm. in the first, and ·14 by ·007 mm. in the second, while those of the holotype measure ·114 by ·006 mm. A fourth specimen in the British Museum, B.M. 27.2.14.136, collected by Kirkpatrick from the reef off Christmas Island at low tide, has spicules measuring ·093 by 0·003 mm. In all but the holotype, which is a pale yellowish-white, the colour of the sponge is dark brown in spirit.

The characteristic features of the species are: (*a*) The surface is thrown into folds, producing irregular ridges and lobose processes; (*b*) the colour, in spirit, is usually dark brown; (*c*) the surface, though appearing smooth to the naked eye, is minutely hispid; (*d*) the ectosome appears detachable to the naked eye, but is actually non-detachable; (*e*) the oxea range from ·093 to ·16 by ·003 to ·008 mm.

DISTRIBUTION.—Malay Area.

Haliclona pigmentifera (Dendy).

Reniera pigmentifera Dendy, 1905, p. 143, pl. ix, fig. 10.

OCCURRENCE.—Low Isles, the Thalamita Flat.

REMARKS.—The single specimen forms an incrustation on a piece of coral rock. The colour, in spirit, is a dark purple-brown, but in life it was black. The surface is porose and the oscules 2 to 3 mm. in diameter with slightly raised margins. The skeleton does not appear to differ perceptibly from that of the holotype.

DISTRIBUTION.—Ceylon.

Haliclona tenuispiculata, sp. n.

Reniera semitubulosa, Dendy, 1921, p. 30; *Reniera* spec. 1, Hentschel, 1912, p. 409; nec *Spongia semitubulosa*, Lamarck.

HOLOTYPE.—B.M. 30.8.13.59.

OCCURRENCE.—Stn. XXII, 11th March, 1929: East of Snake Reef, 13½ fath., mud with foraminifera and shells; Low Isles, the Thalamita Flat.

DIAGNOSIS.—Sponge a mass of cylindrical branches, repent or erect (?); surface minutely hispid, porose; texture soft, friable; oscules 1–3 mm. in diameter, with tendency to linear arrangement along branches; skeleton irregularly sub-isodictyal, generally unispicular but becoming feebly multispicular in parts, with meshes triangular to quadratic; spicules oxea, slightly curved, ·144–·176 by ·004–·007 mm.

REMARKS.—The holotype, a fragment only, consists of three branches which, presumably, had grown in a recumbent position. In general it agrees very closely with the specimen identified by Dendy as *Reniera semitubulosa* (Lamarck), and more particularly with his R.N. LXVIII, 6. Hentschel's *Reniera* spec. 1, appears to be also a representative of the same species.

The characteristic features of the species are: The branching habit, the irregularity of the skeleton and the slender form of the spicules.

A small incrustation, in association with *Iotrochota purpurea* (Carter) and *Jaspis stellifera* (Carter) on a piece of coral rock, shows the typical anatomical details of the species.

DISTRIBUTION.—Malay Area; Indian Ocean.

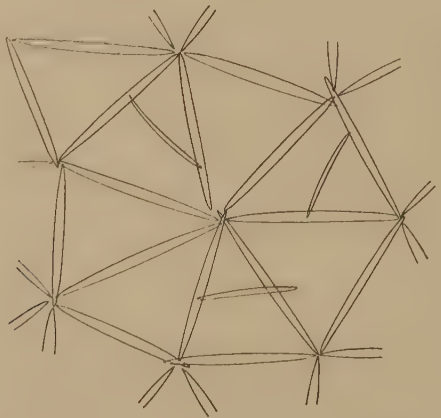
Haliclona flabello-digitatus, sp. n. (Plate I, fig. 10).

HOLOTYPE.—B.M. 30.18.13.167.

OCCURRENCE.—Stn. XIII, 7th March, 1929 : ½ mile W. of Two Is., 16½ fath.

DIAGNOSIS.—Sponge erect, irregularly flabello-digitate; surface even, minutely-hispid, porose; oscules numerous, 3–6 mm. diameter, margins usually level with surface: texture soft, compressible; colour, in spirit, ash-grey; skeleton an isodictyal reticulation of spiculo-fibre, becoming irregular in places, with primary fibres usually ·05 mm. and secondary fibres ·03 mm. thick, meshes of reticulation variable in size, ·2 to ·4 mm. across, and ranging from quadratic to irregularly polygonal; spicules oxea, straight or only slightly curved, ·15 by ·004 mm.; primary fibres cored by oxea arranged in bi- or uniserial lines; secondary fibres aspiculous or containing only uniserial lines of spicules; surface hispid owing to feebly-developed tufts of spicules at distal ends of primary fibres; microscleres absent.

REMARKS.—This species bears a superficial resemblance to *Chalina montagui*, Bowerbank, but differs from it in the absence of a special dermal skeleton. It is probable that the specimen identified by Topsent as *C. montagui*, Bowerbank, from Amboina, may belong to this species.



TEXT-FIG. 4.—*Adocia simulans* (Bowerbank). Portion of dermal skeleton. From holotype. × 200.

Genus *Adocia*, Gray. (Text-fig. 4.)

Adocia, Gray, 1867, p. 522; *Orina*, *idem*, *l. c.*, p. 539; *Siphonochalina*, Schmidt, 1868, p. 7; *Amorphina*, *idem*, 1870, p. 40; *Pellina*, *idem*, *l. c.*, p. 41; *Tubulodigitus*, Carter, 1881, p. 367; *Chalinopora*, Lendenfeld, 1887, p. 764; *Pellinella*, Thiele, 1905, p. 471.

GENOTYPE.—*Chalina simulans*, Bowerbank, 1864, p. 101, pl. xix, fig. 299.

GENOHOLOTYPE.—B.M. 32.1.5.2 (for description and illustration see Bowerbank, 1866, p. 308, 1874, pl. li, figs. 5–6).

DIAGNOSIS.—Haplosceridae with a sub-isodictyal skeleton of oxea, with multispicular ascending fibres joined by irregularly-disposed isolated spicules; special dermal skeleton, a tangential unispicular reticulation of triangular mesh with which small oxea may be associated; microscleres, when present, sigmata and toxa.

REMARKS.—The true characters of *Adocia simulans* have long been obscured and it becomes obvious, now that the nature of the dermal skeleton is determined, that *Pellina*, with genotype *Halichondria semitubulosa*, Lieberkühn (= *Reniera*[*] *semitubulosa*, Schmidt =*Pellina semitubulosa*, Topsent (1925, p. 709)), is a synonym of *Adocia*. *Halichondria angulata*, Bowerbank, the genotype of *Orina*, Gray (*loc. cit.*), has a similar skeleton to that of *Adocia*, but is without microxea in the dermal skeleton and has sigmata and toxa for microscleres. The absence of microxea from the dermal skeleton has little significance, since in undoubted specimens of *Pellina semitubulosa* these spicules vary considerably in number and are often so rare as to be virtually absent.

If we accept the absence of microxea from the dermal skeleton as a point without taxonomic significance, it will be necessary to include two other genera, *Siphonochalina* and *Pellinella*, as synonyms of *Adocia*. *Siphonochalina*, Schmidt, with genotype *S. coriacea*, Schmidt (1868, p. 7, pl. ii, fig. 4), was inadequately described and has been used to include all tubular Haploscleridae without microscleres. This practice, though convenient, is unscientific and has made the genus a heterogeneous collection of species. All that remains of the original specimen described by Schmidt is, so far as is known, a hand section (B.M. 68.3.2.13) in the British Museum collection labelled in Schmidt's handwriting. This is, therefore, accepted here as the holotype. According to this, the spicular characters of *S. coriacea* are precisely those of *Adocia simulans*, except that the microxea are absent.

Acervochalina claviformis, Carter, here chosen as genotype of *Chalinopora*, Lendenfeld, being the first species assigned to that genus, is a typical *Adocia*.

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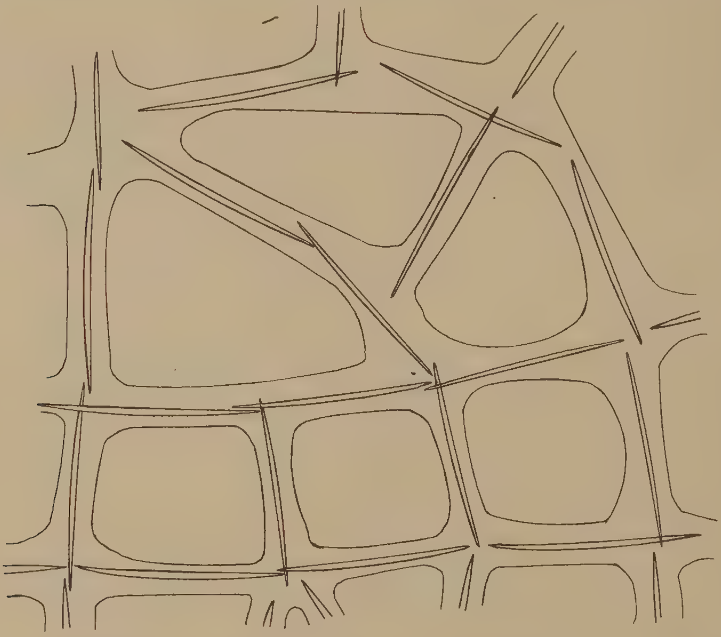
[*] The Genus *Reniera*, Nardo. Nardo (1833, p. 519) established the genus *Rayneria*, giving a brief and inadequate diagnosis, and referring to it a number of species (without diagnosis) of which the first-named was *R. typus*. Later (1847, p. 3), the same author referred to a genus *Reniera*, which, we may infer, was the same thing as *Rayneria*, the difference between the two names being due, presumably, to some question of correctness of spelling. At all events, Nardo, in speaking of *Reniera*, refers to *R. typica* (=*Rayneria typus* ?), as "Il tipo del genere". Since no information is given in Nardo's works, or from those of Schmidt (who often redescribed Nardo's species, we have reason to believe, from the original specimens), both *Rayneria typus* and *Reniera typica* are *nomina nuda*. Vosmaer (1887 p. 339), stated, after referring to the genus *Rayneria*, that "Oscar Schmidt hat dann das Genus in *Reniera* umgeändert und sagt dass die Gattung ungefähr in dem Umfange und mit den Attributen, welche Nardo ihr beilegt, beibehalten werden müsse". To attribute the name *Reniera* to Schmidt is wrong, and this has probably caused many to accept Schmidt's diagnosis of it. And to attempt to retain the genus on the characters "welche Nardo ihr beilegt" is hopeless! The generic name *Reniera* must therefore be abandoned.

In the absence of any exact knowledge of the genus *Reniera*, but clinging to the use of the name with a quite inexplicable tenacity, authors from Schmidt's time to the present day have attributed to it certain characteristics which, as far as may be judged from their writings, are found in *Reniera cinerea* (Grant). This species was first mentioned by Grant (1826, p. 204), without description, under the name *Spongia cinerea*, was again mentioned by Fleming (1828, p. 521) without adequate description, and was first described with anything like completeness by Johnston (1842, p. 111), under *Halichondria cinerea*. Later Bowerbank, (1874, p. 121) redescribed the species, under *Isodictya cinerea*. The specimens used for these descriptions are lost, with the exception of those of Bowerbank, so that it is impossible to say what Grant understood by *Spongia cinerea*, especially in view of the fact that the types of *Chalina montagui*, Bowerbank, and *Isodictya cinerea*, Bowerbank, which are now known to be generically distinct, are practically undistinguishable externally.[*] I therefore accept Bowerbank's specimen (1874, pl. xlviii, fig. 1) of *Isodictya cinerea* as the neotype of *Spongia cinerea*, Grant, and since this is identical with his specimen of *Isodictya simulans* which I propose to make the neotype of *Halichondria simulans*, Johnston (nominated by Gray (1867, p. 522) the type of the genus *Adocia*), the species must be known henceforth as *Adocia cinerea* (Grant).

[*] When writing my paper of 1926, I used Bowerbank's original preparations. Since then, I have found that these are somewhat mixed, a slide not always belonging to the specimen from which it is alleged to have been made. In that paper, therefore, although the fundamental principles still hold good, some of the details have to be revised.

Pellinella, Thiele, with genotype *P. conica*, Thiele (1905, p. 471, figs. 90, 103), has exactly the same spiculation as *Siphonochalina*. The holotype is in the Berlin Museum, but a fragment of it is in the British Museum. According to Thiele (*loc. cit.*) the dermal skeleton in *Pellinella conica* is an irregular reticulation of loose oxea, but in the preparations made from the piece in the British Museum this is not the case, the dermal skeleton being here a regular reticulation of triangular mesh, exactly as in *Adocia simulans*.

Amorphina also appears to be a synonym of *Adocia*. This genus, established by Schmidt (1870, p. 40), was originally intended to include *Halichondria panicea* (Pallas) and a number of new species, and *H. panicea* should, strictly speaking, by its inclusion, have been chosen as genotype. Topsent (1925, p. 711) has, however, declared *Reniera grossa*, Schmidt, to be the type and this is accepted here. According to that author's description of *R. grossa* the dermal skeleton appears to be the same as that found in *Adocia*, and *Amorphina* is therefore here regarded as synonymous with Gray's genus.



TEXT-FIG. 5.—*Tubulodigitus communis*, Carter, showing dermal skeleton. From neotype. × 200.

The genus *Tubulodigitus* was established by Carter (1881, p. 367) for a sponge collected in the Gulf of Manaar, which he called *T. communis*. This specimen cannot be found in the collections of the Liverpool Free Museum or the British Museum. I therefore take Dendy's specimen (B.M. 89.1.21.1), also collected in the Gulf of Manaar, as the neotype of the species. This is a tubular sponge with a regularly isodictyal main skeleton, in which the ascending fibres are bi- or trispicular and the conjunctive fibres unispicular, and a dermal skeleton composed of an irregular reticulation, with meshes varying from triangular to polygonal, but in no way divisible into primary or secondary meshes. The spicules are oxea measuring ·14 by ·004 mm.

The characters of *Tubulodigitus* are, therefore, essentially those of *Adocia* except that the spicules are completely enclosed in spongin (*cf.* Text-figs. 4 and 5). I have been able to show, however, and hope to publish the observations soon, that within the species *Adocia simulans* all transitions occur between the skeletons described and figured here for *Adocia* on the one hand, and *Tubulodigitus* on the other. It will be necessary, therefore, to enlarge our conception of *Adocia* to include also those sponges of which *Tubulodigitus communis*, Carter, is representative.

Adocia toxius (Topsent).

Gellius toxius, Topsent, 1897, p. 470; Hentschel, 1912, p. 391; Dendy, 1921, p. 28.

Occurrence.—Low Isles, Crab Spit, 5th April, 1929; R.P. 2, south-eastern end of Mangrove Swamp; black sponge growing on Mangrove roots, 22nd March, 1929.

Remarks.—The numerous specimens are all of one type. They are erect, tubular sponges, dark brown in colour when preserved in spirit, black in life, with spiculation identical with that of the holotype.

Distribution.—Malay Area; Indian Ocean.

Adocia minor (Dendy).

Siphonochalina minor, Dendy, 1916, p. 115, pl. ii, fig. 15.

Occurrence.—Low Isles, Mangrove Park.

Remarks.—The structure of the skeleton in this species agrees with that of *Adocia simulans* (Bowerbank) in all respects but the absence of sigmata.

Distribution.—West coast of India.

Adocia obtusa (Hentschel).

Gelliodes obtusa, Hentschel, 1912, p. 394, pl. xiv, fig. 6; pl. xvi, fig. 2; pl. xxi, fig. 48.

Occurrence.—Stn. XIX, 10th March, 1929: $\frac{1}{2}$ mile N. of Eagle Is., 10 fath., shell gravel. Stn. XXII, 11th March, 1929: $\frac{1}{2}$ mile N.W. of Howick Is., 10 fath., mud and shell.

Remarks.—Five specimens were obtained, all identical in external form and spiculation and agreeing in these respects with the holotype of the species, except that the oxea measure ·26 by ·006 mm. and the sigmata are absent.

Distribution.—Malay Area.

Adocia pumila (Lendenfeld). (Plate I, figs. 1–7.)

Gellius fibulatus (pars), Ridley, 1884, p. 425; *Siphonochalina pumila*, Lendenfeld, 1887, p. 806; *Gelliodes spinosella*, Thiele, 1899, p. 22, pl. ii, fig. 10; pl. v, fig. 17; *G. porosa*, Thiele, 1903, p. 943; *Gellius ridleyi*, Hentschel, 1912, p. 389 (nec *Gellius fibulatus*, Schmidt, *G. fibulatus*, Dendy, 1905, or *G. ridleyi*, Dendy, 1921).

Occurrence.—Low Isles; between Madrepore Moat and Mangrove Park; Mangrove Park.

Remarks.—The holotype of *Siphonochalina pumila*, Lendenfeld, now in the British Museum, has for main skeleton an isodictyal reticulation of spiculo-fibre, a tangential unispicular skeleton of triangular mesh, with oxea, measuring ·18 by ·008 mm., for megascleres and sigmata, measuring ·024 mm., for microscleres. It is, therefore, a typical *Adocia*.

The main skeleton is chiefly composed of spongin fibres cored by oxea, the primary fibres being multispicular and the secondaries usually uni- or bispicular, but immediately beneath the surface, to a depth of ·2 mm., the skeleton is devoid of spongin. This outer, non-fibrous zone of the main skeleton is probably the most distinctive feature of the whole skeleton. The sponge consists of a system of stout anastomosing branches with large oscules set in series on the upper surfaces and with conulose surface (Plate I, fig. 5).

All the Barrier Reef specimens have the typical skeleton structure and differ but slightly from the holotype in external form (Plate I, figs. 1–4, 6–7).

Both *Gelliodes spinosella*, Thiele, and *G. porosa*, Thiele, judging from the original descriptions, are identical with some of the examples of this species and must be considered synonymous with it, and *Gellius ridleyi* which I have examined, through the kindness of Dr. Max Thiel of the Zoologisch Museum at Hamburg, is certainly the same thing as *Siphonochalina pumila.*

A specimen from Kurrachee described by Ridley (*loc. cit.*) as *Gellius fibulatus* (Schmidt) also belongs to the species.

DISTRIBUTION.—Australia (north coast); Malay Area; Indian Ocean.

Adocia sagittaria (Sollas).

Gellius sagittarius, Sollas, 1902, p. 212, pl. xv, fig. 7; *G. angulatus*, var. *canaliculata*, Dendy, 1905, p. 136, pl. ix, fig. 7.

OCCURRENCE.—Low Isles, east of the Sand Flat and the Thalamita Flat.

REMARKS.—In no single case has a complete specimen of this species been collected, but from the numerous fragments at my disposal it is possible to show that the external form consists of an irregular basal mass bearing a number of fistulae, some of which end in a crown of short filaments, while others end blindly. In all cases the spicules are oxea, sigmata and toxa. The fistulae are very fragile and readily broken off, so that in preserved specimens only in exceptional cases do we find any considerable length of a fistule attached to the body.

The types of this species were described as " consisting of a more dense basal part and of numerous slender tubes arising from this. In one specimen these tubes anastomose; in the second they are broken off and show no indication of how they were arranged ". The measurements of the spicules given were: Oxea, ·3–·35 by ·01–·013 mm.; sigmata, ·012–·016 mm. chord; and toxa, ·049 mm long. The outward form of the sponges was not figured. A few years later, Dendy (*loc. cit.*) described a sponge from Ceylon under the name *Gellius angulatus* (Bowerbank), var. *canaliculata.* This, too, was not figured, but the sub-spherical specimen, now in the British Museum collection, clearly bore in life a number of fistulae which were subsequently broken off and lost. The remains of these were described by Dendy as " a group of vents ". The spicules are: Oxea, ·25 by ·008 mm.; sigmata, up to ·028 mm. chord; and toxa, ·044 mm. long. A conspicuous feature of the specimen, to which Dendy calls attention, is the presence of ramifying exhalant canals lying " just beneath the surface and covered over only by a thin translucent membrane, which is easily rubbed off, leaving the canals as open grooves ".

The Barrier Reef specimens are extremely fragmentary and can only be recognized by their spicules, and by comparison with a number of specimens from the " Siboga " collection, at present in the British Museum.

The colour, in life, of the Barrier Reef specimens is given as magenta and ultramarine.

DISTRIBUTION.—Malay Area ; Indian Ocean.

Adocia fibulatus, var. *microsigma*, Dendy.

Gellius fibulatus, var. *microsigma*, Dendy, 1916, p. 107 ; 1921, p. 26.

OCCURRENCE.—Mangrove Park ; the Thalamita Flat ; Batt Reef and Low Isles.

REMARKS.—There are several specimens growing in association with algae as yet unidentified.

DISTRIBUTION.—Indian Ocean.

Genus *Petrosia*, Vosmaer.

Petrosia strongylata, Thiele.

P. strongylata, Thiele, 1903, p. 938, fig. 2.

OCCURRENCE.—Stn. XXIV, 13th March, 1929 : $\frac{3}{4}$ mile N.E. of Pasco Reef, $16\frac{1}{2}$ fath., foraminifera and coral fragments.

REMARKS.—The first specimen is irregularly massive, approximately 7 cm. long by 3 cm. broad and 3 cm. high, and dark brown in colour. There is a definite tangential dermal skeleton, and the spicules are strongyla of two sizes, ·2 by ·008 and ·06 by ·004 mm., occasionally modified to oxea. In the second specimen the dermal skeleton is often ill-defined in places, but otherwise it agrees with the first, and both differ from the holotype only in the smaller size of the spicules.

DISTRIBUTION.—Malay Area.

Genus *Callyspongia*, Duchassaing and Michelotti.

GENOLECTOTYPE.—*C. fallax*, Duchassaing and Michelotti.

Tuba, Duchassaing and Michelotti, 1864, p. 44 (*nec* Fabricius) ; *Callyspongia*, *eidem*, *l. c.*, p. 57 ; *Cladochalina*, Schmidt, 1870, p. 35 ; *Patuloscula*, Carter, 1882, p. 365 ; *Toxochalina*, Ridley, 1884, p. 402 ; *Dactylochalina*, Lendenfeld, 1886, p. 570 (1 : sep. pag.) ; *Spinosella*, Vosmaer, 1887, p. 342 ; *Ceraochalina*, Lendenfeld, 1887, p. 778 ; *Siphonella*, Lendenfeld (*nec* Macquart, *nec* Hagenow), 1887, p. 808 ; *Euchalina*, *idem*, *l. c.*, p. 817.

DIAGNOSIS.—Haplosceridae with main skeleton a reticulation of spongin fibres cored with oxea ; special dermal skeleton a network of similar fibres subdivided by secondary or even tertiary fibres ; microscleres toxa (and possibly sigmata).

REMARKS.—It has been possible, through the kindness of Dr. M. W. de Laubenfels, to re-examine the type of *Callyspongia fallax*, here accepted as the genolectotype of *Callyspongia*, and to determine that this species is conspecific with *C. eschrittii*, Duchassaing and Michelotti, *Tuba scrobiculata*, Duchassaing and Michelotti, *Patuloscula procumbens*, Carter, and *Ceraochalina vanderhorsti*, Arndt. Although the types of these supposed species vary in shape from massive to ramose or even tubular, the similarity in the skeleton, and the fact that many intermediate forms occur, leave no doubt as to their identity. Another important point is that the three co-types of *Callyspongia eschrittii* all contain abundant toxa. The type of *Patuloscula procumbens* also contains a few, but none could be found in *Callyspongia fallax* or *Tuba scrobiculata*. It seems therefore that, in regard to the variable occurrence of microscleres, *Callyspongia fallax,* in its wider sense, is comparable with *C. ramosa* (see p. 603). As regards the variation in external form the species is likewise comparable with *C. diffusa* (see p. 541).

The genus *Tuba*, Duchassaing and Michelotti, with lectotype *T. sororia*, is preoccupied for a Mollusc (Fabricius, 1823), but the lectotype is a *Callyspongia* closely related to *Tuba armigera*, Duchassaing and Michelotti, which was made the type of the genus *Cladochalina* by Schmidt (1870, p. 35). *C. armigera* differs from *Callyspongia fallax* mainly in the characters of the dermal skeleton ; in the former the primary meshes are subdivided into numerous small secondary and tertiary meshes ; in the latter there is no differentiation into secondary and tertiary meshes and the network is altogether more open than in *Cladochalina armigera.* The difference, which can be best appreciated by comparing Arndt, 1927, p. 155, fig. 16, and Dendy, 1890, pl. lviii, fig. 6, although fairly great, does not prove in practice to be one of generic importance. *Cladochalina* must therefore be regarded as a synonym of *Callyspongia.*

The genus *Patuloscula* must also be considered a synonym of *Callyspongia* since *Patuloscula procumbens* (= *Callyspongia fallax,* see above) is the genotype, and it is worth recording that the dermal skeleton in this species is often echinated, as in *Callyspongia diffusa* (see p. 542, Text-fig. 6).

Desmacidon folioides, Bowerbank, the genotype of *Toxochalina*, has a skeleton like that of *Cladochalina armigera* and has, in addition, toxa for microscleres ; but, as we have seen, these spicules may also be present in *Callyspongia fallax* (the genotype) and *C. ramosa* (a typical species of the genus *Callyspongia*). The only supposedly distinctive feature of *Toxochalina* is therefore lost and this genus also becomes a synonym of *Callyspongia.*

The genus *Spinosella*, Vosmaer (1887, p. 342), for *Tuba sororia*, Duchassaing and Michelotti, also becomes a synonym of *Callyspongia* since, as we have seen above, the genotype cannot be separated generically from *C. fallax.*

Finally, of the many generic names created by Lendenfeld in 1887, *Ceraochalina*, genolectotype *Cladochalina nuda*, Ridley, *Siphonella* (preoccupied Diptera, Macquart, 1835 ; Polyzoa, Hagenow, 1850), genolectotype *Siphonochalina fortis*, Ridley, and *Euchalina*, genolectotype *E. rigida*, must all be considered synonyms of *Callyspongia*, and to these must be added *Dactylochalina*, Lendenfeld, with genotype *D. australis.*

Callyspongia subarmigera (Ridley).

Cladochalina subarmigera, Ridley, 1884, p. 397, pl. xxxix, fig. H ; pl. xli, fig. L ; *Chalinopora subarmigera*, Lendenfeld, 1887, p. 767 ; *Chalina subarmigera*, Lindgren, 1897, p. 481 ; *idem*, 1898, p. 13.

OCCURRENCE.—Stn. XII, 24th February, 1929 : Penguin Channel, 10–15½ fath., rock and shell gravel.

DISTRIBUTION.—Australia (north and east coasts) ; Malay Area.

Callyspongia fibrosa (Ridley and Dendy).

Dasychalina fibrosa, Ridley and Dendy, 1886, p. 330 ; *Pachychalina fibrosa*, Ridley and Dendy, 1887, p. 21, pl. iv, figs. 3–4 ; *Chalina spinifera*, Carter, 1889, p. 66, pl. v, figs. 1–2 ; *Pachychalina spinilamella*, Dendy, 1889, p. 80 ; *P. fibrosa*, Lindgren, 1897, p. 481 ; 1898, p. 11, pl. xix, fig. 6 ; Kirkpatrick, 1900, p. 356 ; *Pachychalina spinilamella*, Dendy, 1905, p. 149, pl. vii, fig. 8 ; *Pachychalina fibrosa*, Dragnewitsch, 1905, p. 26 ; Hentschel, 1912, p. 400 ; *Cladochalina spinilamella*, Burton, 1927, p. 511.

Occurrence.—Stn. XXIV, 13th March, 1929: $\frac{3}{4}$ mile N.E. of Pasco Reef, 16$\frac{1}{2}$ fath., hard and shell bottom.

Remarks.—The specimen closely resembles that described by Carter under *Chalina spinifera*.

Pachychalina spinosissima, Dendy, is not, as Lindgren (1898) suggests, a synonym of this species. Although having a similar external form, the structure of its dermal skeleton suggests an affinity with *Dasychalina*.

Distribution.—Malay Area; Indian Ocean.

Callyspongia confoederata (Ridley).

Tuba confoederata, Ridley, 1884, p. 400; *Siphonella laxa* Lendenfeld, 1887, p. 803, pl. xxiv, fig. 55; *Siphonochalina confoederata*, *idem*, *l. c.*, p. 803, pl. xxv, fig. 60; *S. typica*, *idem*, *l. c.*, p. 804, pl. xxiv, fig. 54; pl. xxvii, figs. 2, 19; *S. elastica*, *idem*, *l. c.*, p. 805; *S. paucispina*, *idem*, *l. c.*, p. 805; *S. axialis*, *idem*, *l. c.*, p. 805, pl. xxiv, fig. 53; *S. extensa*, var. *dura*, *elegans*, *idem*, *l. c.*, p. 806; *Siphonella tuberculata*, *idem*, *l. c.*, p. 808; *Spinosella confoederata*, Topsent, 1897, p. 479, pl. xix, fig. 20.

Occurrence.—Stn. XII, 24th February, 1929: Penguin Channel, 10–15$\frac{1}{2}$ fath., rock and-shell gravel. Stn. XVI, 9th March, 1929: $\frac{1}{2}$ mile W. of N. Direction Is., 20 fath., stony.

Remarks.—The numerous species included above as synonyms of *Callyspongia confoederata* (Ridley) are so obviously members of a single species that it is necessary to say little on this point. The British Museum collection contains the types of all Lendenfeld's species included above and from these it is clear that the structure of the main and dermal skeletons is identical in every case. Moreover, in external form they show no greater variety than those specimens recorded below under *C. diffusa*.

Here, again, is shown the inadequacy of any attempt to differentiate between tubular and non-tubular forms. One specimen, from the present collection, agreeing in structure with the rest, is irregularly massive and gives no sign of even an incipient tubular growth.

Distribution.—Australia (north, east and west coasts); Malay Area.

Callyspongia diffusa (Ridley). (Text-fig. 6.)

Acervochalina finitima (*pars*) Ridley, 1884, p. 399*; *Cladochalina diffusa*, Ridley, 1884, p. 672, pl. xli, fig. D; *idem*, 1884, p. 183; *Cladochalina elegans*, Lendenfeld, 1887, p. 770; *Chalinissa ramosa*, *idem*, *l. c.*, p. 774, pl. xx, fig. 31; *Ceraochalina multiformis*, var. *digitata* (pars: specimen from Port Jackson), *idem*, *l. c.*, p. 784, pl. xix, fig. 20; *Pachychalina multiformis*, var. *manaarensis*, Dendy, 1889, p. 79; *Siphonochalina crassifibra*, *idem*, *l. c.*, p. 82; *Chalina pulvinatus*, Lindgren, 1897, p. 481; *idem*, 1898, p. 13, pl. xviii, figs. 2, 16; pl. xix, fig. 7; *Ceraochalina retiarmata*, *idem*, 1905, p. 152, pl. x, fig. 4; *C. multiformis*, var. *manaarensis*, *idem*, *l. c.*, p. 154, pl. vii, fig. 3; pl. x, fig. 6; *Chalina palmata*, Dendy and Frederick, 1924, p. 499.

Occurrence.—Low Isles, Crab Spit and Mangrove Park. Stn. XIX, 10th March, 1929: About $\frac{1}{2}$ mile N. of Eagle Is., 10 fath., shell, gravel, rich *Halimeda*.

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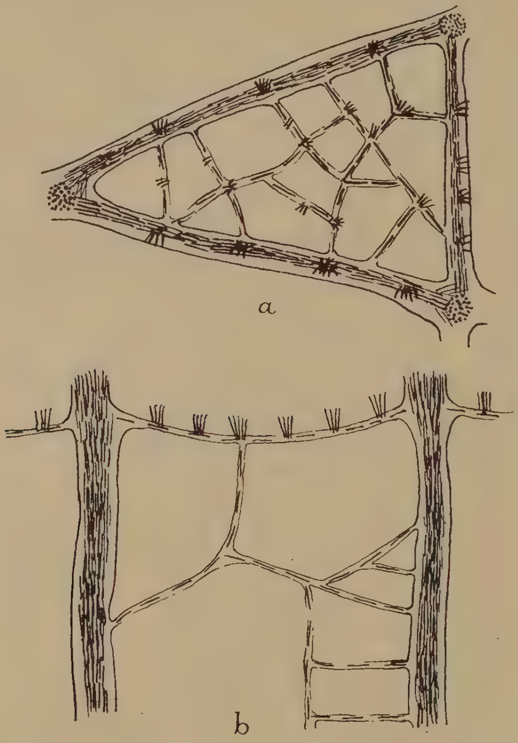
* Ridley (1884) identified 3 specimens with *Acervochalina finitima* (Schmidt). The correct systematic position of these is: Specimen 1 (B.M. 81.10.21.249–250) from Port Jackson = *Callyspongia diffusa*; specimen 2 (B.M. 87.10.21.367) from Percy Island, Queensland = *Haliclona* (*Chalina*) *minor* (Row); specimen 3 (B.M. 82.2.23.267–8) from Alert Island, Torres Straits = *Haliclona* sp. In addition, 2 specimens from the Seychelles were identified as *Acervochalina finitima* (Schmidt) var., and of these the first (B.M. 82.10.17.80–81) is identical with *Haliclona minor* (Row), and the second (B.M. 82.10.17.82) is a *Tubulodigitus* sp. (see Text-fig. 5).

Remarks.—The type of *Cladochalina diffusa*, Ridley, is sub-ramose with flattened branches, sparingly spinose, with small oscules (2–3 mm. diameter), scattered over the surface. The main skeleton consists of an irregular network of stout polyspicular fibres, and the dermal skeleton consists of a network of stout fibres forming a mainly triangular mesh, subdivided by more slender fibres, the whole echinated at intervals by sparse tufts of spicules set out at right angles to the surface (Text-fig. 6*a*). The spicules are oxea measuring ·135 by ·006 mm. The dermal skeleton is particularly striking and serves better than anything else to characterize the species.



Text-fig. 6.—*Callyspongia diffusa* (Ridley), showing *a*, dermal and *b*, main skeletons. × 50. [Although taken from the type of *Chalina pulvinatus*, Lindgren, this drawing represents the typical condition in *Callyspongia diffusa*.]

A precisely similar skeleton is found in the following species: *Ceroachalina multiformis*, varr. *digitata* et *manaarensis*, *C. retiarmata*, Dendy, *C. ceylonica*, Dendy, *Chalina palmata* (Lamarck), Dendy and Frederick, *C. pulvinatus*, Lindgren, *Chalinissa ramosa*, Lendenfeld, *Cladochalina elegans*, Lendenfeld, and *Siphonochalina crassifibra*, Dendy, and it remains to be seen how far these species may be considered identical.

The type of *Ceraochalina ceylonica*, Dendy, differs from that of *Cladochalina diffusa* in having a more markedly spinose surface, and in having fewer spicules in some of the fibres, particularly in the main skeleton. Apart from these differences there is nothing to distinguish the two. *Chalinissa ramosa*, Lendenfeld, from Port Jackson, and *Chalina palmata*, Dendy and Frederick, from Abrolhos Island, have the same branched form as *Cladochalina diffusa*, but are entirely without spines. In addition, there are fewer spicules in the fibres, the fibres of the dermal skeleton usually containing only a uniserial line of spicules. *Chalinissa ramosa* and *Chalina palmata* are undoubtedly identical, and there is no good reason for separating them from *Cladochalina diffusa*.

The Port Jackson specimen of *Ceraochalina multiformis*, var. *digitata*, Lendenfeld, has slightly more spicules than *Chalinissa ramosa*, has a palmo-digitate external form and, apart from the absence of spines, cannot be distinguished from *Cladochalina diffusa*. *Ceraochalina multiformis*, var. *manaarensis*, Dendy (and this applies equally to the specimens from the Gulf of Manaar and from Abrolhos Is.), *C. retiarmata*, Dendy, and *Cladochalina elegans*, Lendenfeld, all have the same type of skeleton as *Chalinissa ramosa* and vary in form from the flabello-digitate, as in *Ceraochalina multiformis*, var. *digitata*, to flabellate.

The next group of species, including *Chalina elegans*, Lindgren, and *Siphonochalina crassifibra*, Dendy, comprises tubular specimens, having the same skeleton as *Cladochalina diffusa*.

The radical step of identifying this group of supposed species of markedly differing external form under one name needs good justification, for it is contrary to all ideas previously held on the classification of the Haplosceridae. But in the Barrier Reef collections we have a batch of specimens which show the following shapes: massive to massive with low tubular oscules; tubular and repent, the tubes anastomosing; erect and tubular; flabellate, with oscules arranged serially around the margin or scattered over one face; cylindrical and repent, with long slender branches. Further, the usually smooth surface may bear a varying number of spines; and their skeletons show the same variations as are met with in that group of "species" now combined under *Callyspongia diffusa*. A most important point is that all the Barrier Reef specimens, with one exception, were collected in the same locality and have the same texture and colour, and may be regarded with a fair degree of certainty as conspecific.

Distribution.—Australia (east and west coasts); Malay Area; Indian Ocean.

Callyspongia clathrata (Dendy).

Chalina clathrata, Dendy, 1905, p. 151, pl. x, fig. 3.

Occurrence.—Stn. XXV, 17th March, 1929: in Papuan Pass, 20–25 fath., foraminifera and coral fragments.

Remarks.—A small encrusting specimen, with a single vent, on *Thorectopsamma irregularis*, sp. n.

Distribution.—Ceylon.

Callyspongia ridleyi, sp. n. (Text-fig. 7.)

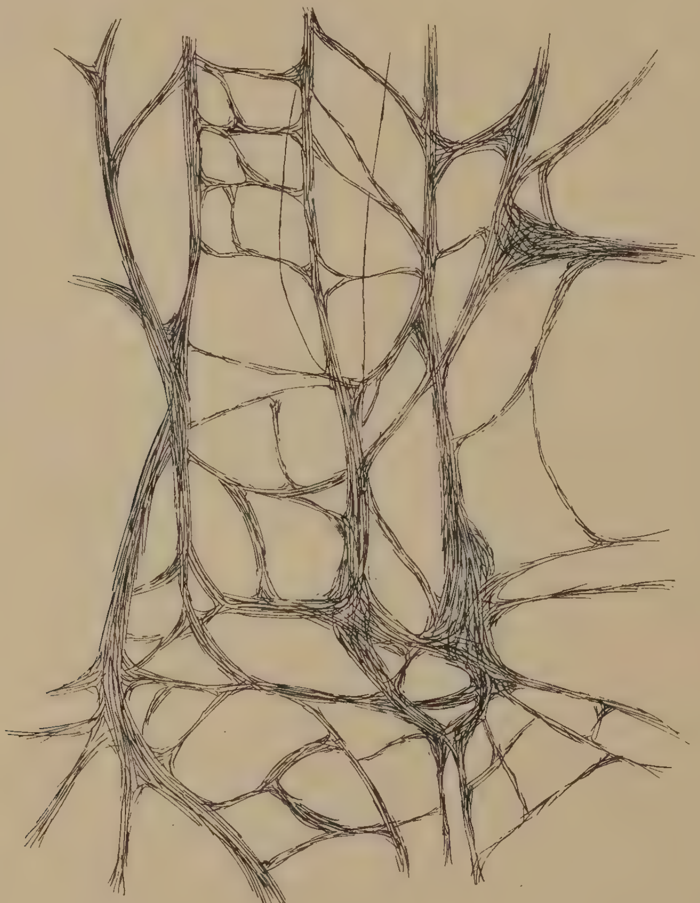
Tuba bullata, Ridley, 1884, p. 399; *nec Spongia bullata*, Lamarck, and *Siphonochalina bullata*, Schmidt.

Holotype.—B.M. 81.10.21.249.

Occurrence.—Low Isles, 8 fath.

Remarks.—The single specimen consists of a large irregularly infundibuliform sponge with smaller lateral outgrowths. The latter are mostly tubular, but occasionally infundibuliform also. The whole colony measures 20 cm. in height and 30 cm. in extent either way. The outer surface is conulose throughout, and in places marked by irregular and inconspicuous ridges. The colour, in the dried state, is brown, and the texture firm and incompressible.

The skeleton of both the present specimen and the holotype are closely similar. The main skeleton (Text-fig. 7*a*) consists of an irregular system of branching and anastomosing fibres, subdivided by more slender fibres. The thicker fibres run generally towards the surface. The dermal skeleton (Text-fig. 7*b*), though very similar, is quite distinct from it, and may readily be separated from its outermost fibres. It consists of an irregular system of stout fibres which branch and anastomose without order, and the meshes formed by this system are subdivided by more slender fibres. In both main and dermal skeletons it is not possible to differentiate clearly between primary and secondary fibres, as is usually the case in the Chalininæ, since both are of varying thickness, and grade one into the other. Some of the slender (secondary ?) fibres, for example, are unispicular, others multispicular and as thick as the more slender of the (primary ?) fibres forming the main system.

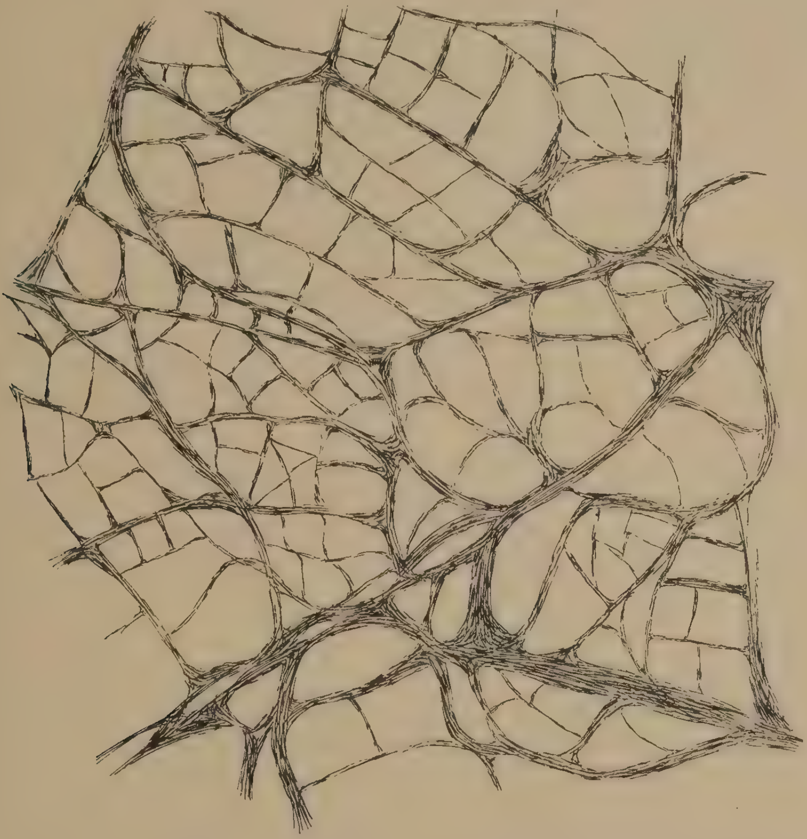


TEXT-FIG. 7*a*.—*Callyspongia ridleyi*, sp. n. Portion of main skeleton. × 26.

The fibres almost invariably contain a fair quantity of spongin, and this is true even of the unispicular fibres, but the number of spicules contained is so numerous and arranged so irregularly that the spongin itself is more or less masked by the spicules. The spicules are oxea measuring ·2 by ·008 mm. There is no sign of the "acuates" recorded by Ridley, and we may reasonably regard such as occur in the holotype as abnormal oxea.

Spongia bullata, Lamarck, with which Ridley believed his specimen to be identical, is an *Adocia* with a totally different arrangement of the skeleton.

DISTRIBUTION.—Port Molle and Port Curtis, Queensland.



TEXT-FIG. 7*b*.—*Callyspongia ridleyi*, sp. n. Portion of dermal skeleton. × 26.

Genus *Oceanapia*, Norman.

Oceanapia, Norman, 1869, p. 334; *Rhizochalina*, Schmidt, 1870, p. 35; *Phloeodictyon*, Carter, 1882, p. 122.

REMARKS.—There has been much uncertainty about the use of the three names, *Oceanapia*, *Rhizochalina* and *Phloeodictyon*, but it is fairly certain that we must regard them as synonyms. The external form and the structure of the skeleton is identical in each of these genera, but whereas *Oceanapia* possesses sigmata, the other two do not. *Rhizochalina* and *Phloeodictyon* must therefore be considered as synonyms without hesitation, and it merely remains to be determined whether the presence or absence of sigmata can be regarded as a basis for generic distinction, as has been done by most authors. Experience shows that the ease with which microscleres may be lost is far greater than is ordinarily recognized. In the present instance we have examples of this, but the significance has usually been overlooked or wrongly interpreted. The holotype of *Rhizochalina*, *R. oleracea*, for example, has no sigmata, but *R. carotta* from the same locality, and clearly congeneric if not conspecific, has. Topsent (1920, pp. 5–6) recognizes from this that *Rhizochalina* may or may not possess sigmata, and this, in my opinion, is the only view possible, in which case there can be no distinction between that genus and *Oceanapia* and *Phloeodictyon*.

In this connection Dendy (1905, p. 166) found "that at one of the "Challenger" stations, specimens of *Phloeodictyon fistulosum* with and without sigmata appear to occur together, and are so closely similar in external appearance that they cannot be distinguished otherwise than microscopically". And on the strength of this Dendy united *Rhizochalina*, without sigmata, and *Oceanapia*, with sigmata, in one genus.

He seems then to have changed his mind and asserted that: "It seems equally reasonable, however, to suppose that the two genera (*i. e. Rhizochalina* and *Oceanapia*) actually occur together in this locality, or that there has been some confusion in the sorting out of the specimens". This seems to be clearly a case of taking a difficult detour to avoid an obvious truth.

Oceanapia fistulosa (Bowerbank).

(For synonymy see Dendy, 1905, p. 165.)

Occurrence.—Low Isles, S.E. of Mangrove Park. Stns. II and III, 24th November, 1928: Linden Bank, 28 fath., shell and sand.

Distribution.—Australia (west and north coasts); Malay Area; Indian Ocean; Azores (?); Bahia (?).

Oceanapia renieroides, sp. n.

Holotype.—B.M. 30.8.13.49.

Occurrence.—Low Isles, 28th March, 1929.

Diagnosis.—Sponge massive (or sub-spherical ?) with blind fistulæ; surface smooth; texture friable; colour, in spirit, white, main and tangential dermal skeletons of body a unispicular and triangular mesh; dermis of fistulae supported by tangential skeleton like that of body, with a sub-dermal multispicular reticulation of polygonal mesh; spicules oxea, measuring ·14 × ·005 mm.

Remarks.—Only a few fragments of the body and a fistule remain. The texture of the sponge is very unlike that of the usual *Oceanapia* species. This is because the skeleton is unispicular throughout. The species is most nearly related to *Phloeodictyon polysiphonia*, Dendy, from the Indian Ocean, but in that species the spicules of the main skeleton tend to be arranged in multispicular fibres.

Oceanapia elastica (Keller).

Reniera elastica, Keller, 1891, p. 306, pl. xvi, figs. 3, 7; *Petrosia elastica*, Lindgren, 1897, p. 480; *idem*, 1898, p. 5, pl. xviii, fig. 13; pl. xix, fig. 5.

Occurrence.—Stn. XVII, 9th March, 1929: ¼ mile N. of N. Direction Is., 19 fath., sand; Stn. XXXV, 17th March, 1929: in Papuan Pass, 20–25 fath., foraminifera and coral fragments.

REMARKS.—The holotype of *Reniera elastica*, Keller, appears to be nothing more than the fistule of a specimen of *Oceanapia*, and Lindgren's specimens, which I have been able to examine, certainly are. The first of the present specimens, consisting of a fistule 11 cm. long and encrusted with a species of Gorgonid, is identical with Lindgren's specimens and, there is little reason for doubt, with the holotype.

The second specimen consists of a sub-spherical body bearing on its upper surface the bases of a few small fistulae. That this belongs also to Keller's species, there can be no doubt, but since the general form of the sponge is similar to that of *Oceanapia fragilis*, Topsent, and the skeleton much the same except for the absence of sigmata, it is probable that Keller's species is identical with Topsent's *O. fragilis*.

DISTRIBUTION.—Malay Area ; Red Sea.

Family DESMACIDONIDAE.

Section ISODICTYEAE.

Genus *Desmapsamma*, gen. n.

GENOTYPE.—*Fibularia anchorata*, Carter, 1882, p. 283.

DIAGNOSIS.—*Isodictyeae* with a special dermal skeleton of multispicular fibres forming an irregular reticulation of polygonal mesh ; much sand incorporated in skeleton ; spicules oxea, tridentate isochelae and sigmata.

REMARKS.—*Fibularia anchorata*, Carter, was originally described from a specimen from Antigua, West Indies, and is identical with that described later by Ridley and Dendy from Bahia, as *Desmacidon reptans*. Lindgren, later still, recorded *D. reptans* from the Indo-Pacific. I have compared the types of *Fibularia anchorata* and *Desmacidon reptans* with Lindgren's specimen of *D. reptans*, those of the present collection, and several from the " Siboga " collection, which I had provisionally identified as *D. reptans*. As the result of this comparison, there can be no doubt that these specimens represent a single species distributed alike in the West Indian and the Indo-Australian regions.

Arndt (1927, p. 147) realizing the affinity of *Fibularia anchorata* Carter to the genus *Desmacidon*, referred it to that genus, and changed the specific name to *D. carterianum*. This he did under the impression that *Axos anchorata*, Carter, an earlier species, also belonged to *Desmacidon*. *Axos anchorata*, however, belongs to the genus *Plumocolumella*.

Desmapsamma anchorata (Carter).

Fibularia anchorata, Carter, 1882, p. 283; *Desmacidon reptans*, Ridley and Dendy, 1886, p. 345; *idem*, 1887, p. 105, pl. xxiii, fig. 7 ; Lindgren, 1897, p. 482 ; *idem*, 1898, p. 21 ; *D. carterianum*, Arndt, 1927, p. 147.

OCCURRENCE.—Low Isles ; the Thalamita Flat.

DISTRIBUTION.—Malay Area ; West Indies ; Bahia.

Section MYCALEAE.

Genus *Mycale*, Gray.

Mycale grandis, Gray.

Mycale grandis, Gray, 1867, p. 533 ; *M. armata*, Thiele, 1903, p. 950, fig. 16 ; *M. grandis*, Hentschel, 1912, p. 337, pl. xviii, fig. 15.

Occurrence.—Stn. XVII, 9th March, 1929: ½ mile N. of N. Direction Is., 19 fath., sand and thick *Halimeda*.

Remarks.—The species is represented by two small massive specimens.

Distribution.—Malay Area.

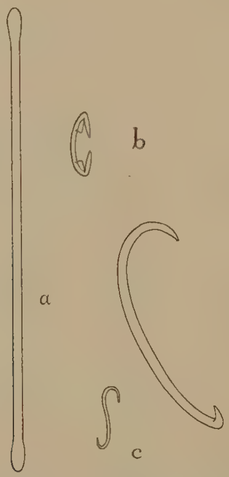
Mycale sulevoidea (Sollas).

Esperella sulevoidea, Sollas (Miss), 1902, p. 213, pl. xiv, figs. 8–9; pl. xv, fig. 10; *Mycale sulevoidea*, Hentschel, 1912, p. 335, pl. xii, fig. 6; pl. xviii, fig. 14.

Occurrence.—Stn. XVII, 9th March, 1929: ½ mile N. of N. Direction Is., 19 fath., sand and thick *Halimeda*.

Remarks.—There are three flagelliform sponges, of which the largest measures 35 cm. long and 1·5 cm. in diameter at the thickest point. The shape is unusual for the species, the only other specimens recorded being encrusting, but the spiculation leaves no doubt as to the identity of these specimens.

Distribution.—Malay Area.



Text-fig. 8.—*Histoderma calcifera*, sp. n. *a*, Tornote, × 190; *b*, chela, and *c*, sigmata, showing the range in size, × 500.

Section Myxilleae.

Genus *Histoderma*, Carter.

Histoderma calcifera, sp. n. (Text-fig. 8).

Holotype.—B.M. 30.8.13.228.

Occurrence.—Stns. II and III, 24th November, 1928: Linden Bank, 28 fath., shell sand.

Diagnosis.—Body massive, entirely hidden by a covering of calcareous *débris*, with blind fistulae projecting upwards; texture of body firm but compressible; skeleton composed of amphitylota, tylostrongyla or strongyla, ·35 by ·007 mm., scattered without order in inner tissues; microscleres chelae arcuatae, between ·02 and ·026 mm. chord and sigmata, varying from ·028 to ·07 mm. or more.

REMARKS.—The skeleton in this species contains nothing remarkable or characteristic, and differs from that of other species of *Histoderma* largely in the dimensions of the spicules. The external form, and particularly the coat of calcareous matter is, however, peculiar.

Genus *Hamigera*, Gray.

Hamigera strongylata, sp. n.

HOLOTYPE.—B.M. 30.8.13.79.

OCCURRENCE.—Stn. IX, 2nd February, 1929: Penguin Channel, 12–14 fath.; Stn. XII, 24th February, 1929: Penguin Channel, 10–15½ fath., rock and shell gravel.

DIAGNOSIS.—Sponge irregularly massive; surface uneven, glabrous; pore areas well-defined, numerous; oscules not apparent; colour, in spirit, yellowish grey; choanosome supported by an irregular reticulation of triangular, quadratic or polygonal mesh; dermis for most part aspiculous, except around pore-areas, where megascleres are radiately arranged; megascleres strongyla, with ends occasionally slightly swollen, ·28 by ·004 to ·008 mm.; microscleres isochelae of usual form ·03 mm.

REMARKS.—The species is unique in having only one form of megasclere. The chelae have almost the same form as those of *H. papillata*, Dendy and *H. dendyi*, Shaw, and it is possible that the present species may be a reduced form of one of these species or some allied species. Had it not been for the presence of characteristic pore-areas and chelae, which indicates the affinities to *Hamigera*, it would have been necessary to include this species among the reduced Myxilleae of uncertain affinity (see p. 554).

Genus *Plumocolumella*, Burton.

Plumocolumella anchorata (Carter).

Axos[*] *anchorata*, Carter, 1881, p. 382, pl. xviii, fig. 3.

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[*] *Axos*, Gray.

The genus *Axos*, established by Gray (1867, p. 545) for a spicule-drawing by Bowerbank (1862, p. 260, fig. 197), contains at present five species. In the British Museum collection there is a small portion of a sponge which may be accepted as the holotype of *A. cliftoni*, the genotype. This specimen is labelled, probably in Gray's handwriting, "*Axos cliftoni* Gray, West Australia, G. Clifton, Esq.," and its skeleton includes spicules of the form recorded by Bowerbank (*l. c.*, fig. 197). The complete spiculation consists of radial bundles of styli and an uninterrupted mass of asters filling both cortex and choanosome. The asters have six cylindrical rays, truncated and ornamented at the ends with four or more stout spines. Bowerbank's figure is badly drawn, and misleading, but it does illustrate the appearance of the spicule when seen from a certain angle. The typical appearance of the aster is, however, very like that of the micrasters of such species of *Tethya* as *T. robusta*, Bowerbank, and for this reason the genus *Axos* is here assigned to the family Tethyadae.

Of the remaining species *A. flabelliformis*, Carter (1879, p. 285, pl. xxvi, figs. 1–4), is congeneric with *A. cliftoni*, Gray; *A. spinipoculum* Carter (*l. c.*, p. 286, pl. xxv, figs. 1–9), belongs to the Acarneae; *A. fibulata*, Carter (1881, p. 383, pl. xviii, fig. 4), of which the holotype is lost, is probably identical with *Gelliodes fibulatus*, Ridley; and *A. anchorata*, Carter (*l. c.*, p. 382, pl. xviii, fig. 3), belongs to the Myxilleae and may be placed provisionally in the genus *Plumocolumella*, Burton (1929, p. 424). Further, *Axos spinipoculum*, Carter, must be assigned to a new genus for which the name *Diacarnus*, gen. n., is proposed, in recognition of its characteristic spicules, consisting of a straight shaft bearing a whorl of four recurved teeth just below the point at each end and two irregular whorls of spines near the centre. This spicule seems to be directly comparable with the cladotyla of *Acarnus*.

OCCURRENCE.—Stn. XXIII: Turtle Is., 8 fath., mud and shell.

DISTRIBUTION.—Bass Strait, Australia.

Genus *Strongylacidon*, Lendenfeld.

Strongylacidon inaequalis, Hentschel.

Batzella inaequalis, Hentschel, 1911, p. 325, fig. 20.

OCCURRENCE.—Stn. XIX: ½ mile N. of Eagle Is., 10 fath., shell, gravel and rich *Halimeda*.

REMARKS.—The first three specimens are in the form of extensive blue incrustations on a *Hircinia*. The fourth is small and massive, dark brown in colour, and consists of an irregular basal plate, from which spring small vertical lamellae, or digitate processes, with conulose surface. The fifth specimen, 9 cm. high, consists of a single lamella bearing lateral and terminal digitate processes. The surface is coarsely conulose and the colour, in spirit, dark brown. The skeleton in this specimen consists of a stout reticulation of horny fibres cored by irregularly plumose bundles of typical strongyla. In places the fibre disappears and the skeleton consists of feeble, plumose bundles of strongyla running towards the surface and ending there in feebly-marked surface brushes.

DISTRIBUTION.—S.W. Australia.

Strongylacidon intermedia, sp. n. (Text-fig. 9.)

HOLOTYPE.—B.M. 30.8.13.87.

OCCURRENCE.—Stn. XIX: ½ mile N. of Eagle Is., 10 fath., shell, gravel and rich *Halimeda*.

DIAGNOSIS.—Sponge massive, sub-clathrous, with short digitate processes given off at various points; surface uneven, coarsely hispid, aculeate; texture compressible; oscules not seen; colour, in spirit, pale greyish-brown; skeleton composed of irregular fibres, branching and anastomosing, running generally towards the surface and cored by plumose bundles of slender strongyla, occasionally modified to styli, measuring ·14 by ·003 mm.

REMARKS.—The species differs from *S. inaequalis* (Hentschel), in that the spicules are collected into fibres and surrounded by spongin. On the other hand, it has considerable resemblance to *Echinochalina anomala*, Hallmann, and might almost be regarded as an *Echinochalina* which has lost its echinating styli.

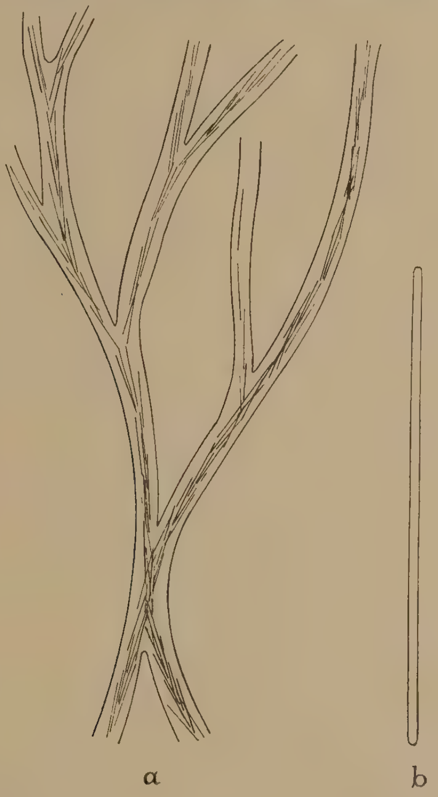
Genus *Psammochela*, Dendy.

Psammochela fibrosa (Ridley).

Phoriospongia fibrosa, Ridley, 1884, p. 439, pl. xlii, fig. g; *Psammochela elegans*, Dendy, 1916, p. 128, pl. i, fig. 6; pl. iii, fig. 22.

OCCURRENCE.—Stn. XXII, 11th March, 1929: E. of Snake Reef, 13½ fath., mud with foraminifera and shells, dredged.

REMARKS.—There can be little doubt that *Phoriospongia fibrosa*, Ridley, and *Psammochela elegans*, Dendy, represent a single species. The resemblance between them in external form and in the types of spicules present is too great for it to be otherwise. Ridley (*loc. cit.*, p. 440) speaks of the megascleres as " acerates . . . with very slightly enlarged, subpyriform basal ends ". In other words, the megascleres are " acuates " (= styli) not " acerates ". The main difference between Dendy's and Ridley's specimens is in the composition of the skeleton fibres. Dendy describes them as " composed of sand-grains and megascleres in varying proportions with no visible spongin ", but this description does not lay sufficient emphasis on the important details. In the majority of his specimens, for example, the fibres are filled almost entirely with styli, with little foreign matter, but in R.N. IV.12, X and XXXIV.11, they are composed exclusively of sand and foraminiferal *débris*, with the styli sparingly associated. The condition found in these last three specimens is thus practically the same as that found in Ridley's sponges.



TEXT-FIG. 9.—*Strongylacidon intermedia*, sp. n. *a*, Portion of the skeleton showing the arrangement of the fibres, × 70; *b*, strongyle, × 500.

The present specimen is much macerated, and its identification is therefore doubtful. The external form is much the same as that of the irregularly massive forms described by Dendy, and the surface is irregularly conulose, but the dermal membrane which should span the intervals between the conuli is entirely absent. The skeleton is an irregular reticulation of horny fibres cored by bundles of slender styli, the styli measuring ·16 by ·001 to ·002 mm. Microscleres are entirely absent but in view of the macerated condition of the sponge this is not surprising. Assuming that this is truly a representative of *Psammochela fibrosa*, as seems probable, we have an interesting series of forms in which the fibres of the skeleton show a wide range of variation. On the one hand, they may be composed of styli only, "with no visible spongin" (*fide* Dendy, *loc. cit.*, p. 126), or they may be composed entirely of sand-grains and calcareous *débris*, with only a small amount of spongin, or in extreme cases, foreign inclusions may be entirely absent and the skeleton consist of stout spongin fibres cored by proper megascleres. This is precisely the same as the sequence of variations found in *Spongelia fragilis* (see p. 583), and is comparable with the condition found in *Chondropsis chaliniformis* (see below). It is a striking illustration of the way in which the amount of spongin fluctuates in different individuals of a single species (*cf.* Burton, 1926).

Distribution.—Indian Ocean ; Northern Australia (Torres Straits).

Genus *Chondropsis*, Carter.

Chondropsis chaliniformis (Carter).

Dysidea chaliniformis, Carter, 1885, p. 217 ; *Phoriospongia chaliniformis*, Lendenfeld, 1889, p. 600, pl. xxxvii, fig. 8 ; pl. xl, figs. 1, 3 ; pl. xli, fig. 2 ; *Chondropsis chaliniformis*, Burton, 1929, p. 433.

Occurrence.—Stns. II and III, 24th November, 1928 : Linden Bank, 28 fath., shell and sand.

Remarks.—The specimen consists of a mass of branches growing erect from a single stoloniform branch. The latter is angulate and irregular, but the erect branches are smooth and rounded, with a maximum diameter of 5 mm. In appearance the sponge approximates most nearly to the one recorded by me from the Antarctic, although differing in the composition of the skeleton. In the type the skeleton consists of stout fibres of spongin filled with large sand-grains. In the "Terra Nova" specimen, it is composed of foreign spicules exclusively, and in the present specimen of small sand-grains. The species shows, therefore, the same wide selection of extraneous matter for constructing a skeleton, as is seen in *Spongelia fragilis*.

There are also two small specimens of the dimensions and shape of those figured by Lendenfeld (*loc. cit.*, pl. xxxvii, fig. 8, and pl. xl, fig. 3). The fibres of the skeleton are filled with sand-grains of the same size as those found in the type of the species, but there are, in addition, so many foreign spicules present that it is practically impossible to determine whether proper megascleres are present or not.

The embryo of this species has been figured by Lendenfeld and it is noteworthy that an incipient tangential dermal skeleton is present (*cf.* Burton, 1931, p. 523).

Distribution.—Australia (north, east and south coasts) (*fide* Lendenfeld, *loc. cit.*) ; McMurdo Sound, Antarctic.

Chondropsis carcinophila, Lendenfeld.

Sigmatella carcinophila, Lendenfeld, 1889, p. 615, pl. xli, fig. 8.

Occurrence.—Stn. XIX, 10th March, 1929 : about ½ mile N. of Eagle Is., 10 fath.

Remarks.—The specimen has been dissected for the removal of a number of parasitic (?) Amphipoda, but appears to have been massive and low-growing. Its dimensions were approximately 2½ by 2 cm. across by ·5 cm. high. The surface is tolerably smooth, but thrown into a number of low tubercles or rounded ridges. The choanosome is densely crowded with foreign matter, chiefly sand, arranged as in *Sigmatella australis*, var. *tubaria*, Lendenfeld (*loc. cit.*, pl. xlii, fig. 5), but more abundantly present. Associated with this sandy skeleton are a number of slender spicules, probably strongyla, so much mixed up with sand-grains that it is not possible to be quite certain of the shape of their ends. They measure ·2 by ·001 mm., and are usually flexuous.

This specimen seems to agree with *S. carcinophila*, Lendenfeld, in all essential features except that the surface is not conulose but tuberculate or ridged.

Distribution.—Australia (east coast).

Genus *Iotrochota*, Ridley.

Iotrochota purpurea (Bowerbank).

Halichondra purpurea, Bowerbank, 1875, p. 293; *Iotrochota purpurea*, Ridley, 1884, p. 434, pl. xxxix, fig. L; pl. xlii, fig. e; Topsent, 1897, p. 455; Dendy, 1905, p. 164; Hentschel, 1912, p. 348; Dendy, 1921, p. 97.

Occurrence.—Low Isles, the Thalamita Flat.

Remarks.—The first three specimens are thinly encrusting, with here and there an incipient branch growing upwards. A fourth specimen is branched and closely resembles that figured by Ridley (*loc. cit.*, pl. xxxix, fig. L).

The colour in life has been variously recorded as velvet-black and indigo.

Distribution.—Malay Area; Indian Ocean.

Iotrochota coccinea (Carter).

Halichondria birotula, Carter, 1886, p. 52 (*nec Halichondria birotula*, Higgin); *Axinella coccinea*, Carter, 1886, p. 378; *Iotrochota coccinea*, Dendy, 1896, p. 23.

Occurrence.—Stn. X, 22nd February, 1929: Satellite Reef, 14–17 fath., coral, shell, gravel and mud.

Remarks.—The specimen agrees closely with the type in general features, but differs in the megascleres, which though of typical dimensions are exclusively strongylote.

Distribution.—Australia (south coast).

Genus *Crella*, Gray.

Crella spinulata (Hentschel).

Grayella spinulata, Hentschel, 1911, p. 340, fig. 29.

Occurrence.—Stn. IX, 22nd February, 1929: Penguin Channel, 12–14 fath., mud. Stn. XII, 24th February, 1929: Penguin Channel, 10–15½ fath., rock and shell gravel, mud on edges of pit. Stn. XXII, 11th March, 1929: E. of Snake Reef, 13½ fath., mud with foraminifera and shells.

Remarks.—The sponge is branching, with branches cylindrical and 3–5 mm. in diameter, and agrees with the holotype in external features. The spicules have the same form and dimensions as those of the holotype, but differ slightly in arrangement. The dermal skeleton is typical, but the main skeleton consists of a regular reticulation of triangular mesh, formed by the acanthoxea with occasional bundles of tornota running towards the surface.

Distribution.—S.W. Australia.

Appendix to the Myxilleae.

There are many species of doubtful affinity in which the spiculation consists of smooth monactinal or diactinal megascleres, with some form of chela for microscleres, and the practice has been hitherto to refer these to either the genus *Batzella*, or the genus *Desmacidon*, in the sub-family Isodictyeae, so that these two genera have tended, in practice, to serve for the reception of all Desmacidonidae of doubtful affinity. The Isodictyeae was intended to include, in the first place, the genus *Isodictya*, with genotype *I. palmata*, Johnston, which has oxeote megascleres and chelae and sigmata for microscleres, and differs from the genus *Chalina* almost entirely in the possession of microscleres. In the genus *Batzella* and such species as *Desmacidon plicatum*, Hentschel, *D. psammodes*, Hentschel, *D. arenosa*, Whitelegge, *D. chaliniformis* (Carter), Dendy, *D. stelliderma* (Carter) Dendy, and *D. dendyi*, Whitelegge, the megascleres, where present, are tornota and this alone justifies their removal from the Isodictyeae to the Myxilleae, the characteristic feature of which is the possession of tornota of various forms as auxiliary spicules, either forming a dermal skeleton exclusively, or, as in *Anchinoë*, entering also into the main skeleton.

The type of the genus *Batzella*, *B. inops*, Topsent, has, according to the original description, strongyla (? tornota) scattered loosely in the tissues, but the description of the skeleton is not sufficient to settle beyond doubt the affinities of the species. *Desmacidon columella*, Bowerbank, also referred to *Batzella*, has unequally ended strongyla and styli for megascleres, but no microscleres, and is evidently a reduced *Mycale*. A new genus must, therefore, be made for its reception, and for this I propose the name, *Hemimycale*, gen. n. *Batzella corticata*, Thiele, is closely related to *Rhaphoxya*, Hallmann, but differs in having a tangential dermal layer of short strongyla, not recorded by Thiele, about half the length of the principal megascleres. For this species I propose the name *Rhaphoxiella*, gen. n. *Batzella mollis*, on the other hand, belongs to *Rhaphoxya*, while *Batzella inaequalis*, Hentschel (1911), although without microscleres, may justly be referred to *Strongylacidon*, for although the megascleres tend to be anisostrongylote, their arrangement in the skeleton is much the same as in *S. sansibarensis*, Lendenfeld, the genotype.

Desmacidon plicatum, Hentschel, is identical with *Halichondria stelliderma*, Carter (= *Desmacidon stelliderma* (Carter)), a species which rightly belongs to *Strongylacidon*, but *Desmacidon psammodes*, Hentschel, represents one new genus, and *Homœodictya dendyi*, Hentschel, represents a second, for which the names *Anomomyxilla*, gen. n., and *Anomodoryx*, gen. n., are here proposed. *Desmacidon arenosa*, Whitelegge, and *D. chaliniformis* (Carter), Dendy, are species of very doubtful affinity in which the skeleton, except for the microscleres, which resemble those of the Myxilleae, is replaced by sand and other foreign inclusions. For these, too, a new genus is necessary, and the name *Psammodoryx*, gen. n., is proposed.

All these forms are of doubtful affinity but, with the exception of *Hemimycale* and *Rhaphoxiella*, show some relationship to the Myxilleae and, pending further information, should be included in an appendix to that sub-family. *Plumocolumella*, Burton, must likewise be included in such an appendix.

The following is a summary of the genera discussed above :

Genus *Batzella*, Topsent.

GENOTYPE.—*Halichondria inops*, Topsent, 1891, p. 533, pl. xxii, fig. 1.

DIAGNOSIS.—Reduced Myxilleae with skeleton composed of slender strongyla scattered sparsely throughout choanosome ; no special dermal skeleton ; no microscleres.

Genus monotypic.

Genus *Strongylacidon*, Lendenfeld.

GENOTYPE.—*Strongylacidon sansibarensis*, Lendenfeld, 1897, p. 110, pl. x, figs. 106–116.

DIAGNOSIS.—Reduced Myxilleae with skeleton of slender strongyla, often slightly tylote at one or both ends, arranged in loose fibres running vertically to surface ; fibres tending to branch and anastomose in places, giving rise to an irregular network ; distal end of fibres projecting slightly at surfaces ; no special dermal skeleton ; microscleres chelae unguiferae.

The above diagnosis is based on examination of a preparation from the holotype in the British Museum collection.

Genus includes : *S. sansibarensis*, Lendenfeld, *Halichondria stelliderma*, Carter (with its synonym *Desmacidon plicatum*, Hentschel).

Genus *Plumocolumella*, Burton.

GENOTYPE.—*Fibulia carnosa*, Carter, 1886, p. 51.

DIAGNOSIS.—Reduced Myxilleae with skeleton of bundles of oxeote tornota running vertically to surface and ending in dermal brushes ; fibres usually curved or sinuous, often branching and anastomosing to form an irregular network ; microscleres isochelae unguiferae.

For list of species, see Burton, *loc. cit.*, p. 425.

Genus *Anomomyxilla*, gen. n.

GENOTYPE.—*Desmacidon psammodes*, Hentschel, 1911, p. 322, fig. 19.

DIAGNOSIS.—Reduced Myxilleae with skeleton of slender strongylote tornota, sometimes modified to irregular styli, arranged in loose fibres running vertically to surface and ending in loose dermal brushes ; fibres tending to branch and anastomose giving rise, in places, to an irregular network ; main skeleton containing much sand and foreign spicules ; dermis supported by a close-meshed network of fibre filled with sand and foreign spicules ; microscleres isochelae unguiferae and sigmata.

Genus monotypic.

Genus *Anomodoryx*, gen. n.

GENOTYPE.—*Desmacidon dendyi*, Whitelegge, 1902, p. 79, pl. x, fig. 9.

DIAGNOSIS.—Reduced Myxilleae with skeleton of amphitylote tornota arranged in slender fibres which branch and anastomose to form radial fibre systems running vertically to surface ; no special dermal skeleton ; microscleres chelae arcuatae and sigmata.

Genus monotypic.

Genus *Psammodoryx*, gen. n.

Genotype.—*Dysidea chaliniformis*, Carter, 1885, p. 217.

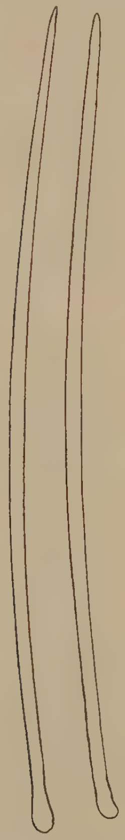
Diagnosis.—Reduced Myxilleae (?) with skeleton composed of a reticulation of horny fibres filled with sand and foreign spicules; microscleres isochelae unguiferae.

The genus includes, besides the genotype, *Desmacidon arenosa*, Whitelegge.

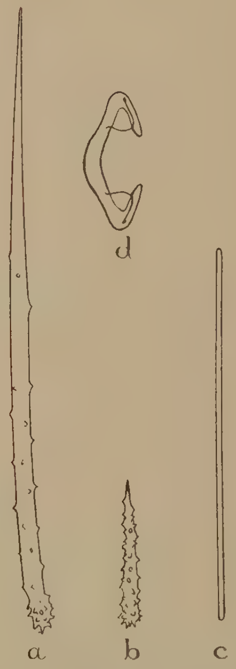
Hemimycale, gen. n. (Text-fig. 10.)

Genotype.—*Desmacidon columella*, Bowerbank, 1874, p. 243, pl. lxxviii, figs. 6–8.

Diagnosis.—Reduced Mycaleae with skeleton of loose fibres of styli, sometimes modified to anisostrongyla, running vertically to surface; fibres tending to branch and anastomose; no special dermal skeleton; no microscleres.



Text-fig. 10.—Spicules of *Hemimycale*, gen. n., *columella* (Bowerbank), × 300.



Text-fig. 11.—*Hymedesmia*, cf. *tenuissima* (Dendy). *a*, Large acanthostyle; *b*, small acanthostyle; and *c*, tornote, × 300; *d*, chela, × 360.

Hemimycale columella (Bowerbank) is a species of uncertain affinity and has, as a result, been placed in several different genera at different times. The original figure of its spicules is erroneous and has led to much misconception. Instead of anisostrongyla, such as figured by Bowerbank, its skeleton is composed of styli (Text-fig. 10), with occasional strongyla as a modification of these. There is good reason, therefore, for placing the species among the Mycaleae.

Genus *Rhaphoxiella*, gen. n.

Genotype.—*Batzella corticata*, Thiele, 1905, p. 438, fig. 58.

Diagnosis.—Axinellidae with skeleton of loose, irregular fibres, formed of curved styli, oxea or strongyla, running vertically to surface ; numerous spicules, including also short oxea and strongyla, scattered between fibres ; dermal skeleton a tangential reticulation of short strongyla ; no microscleres.

Genus monotypic.

Section Clathrieae.

Genus *Hymedesmia*, Bowerbank.

Hymedesmia mertoni, Hentschel.

H. mertoni, Hentschel, 1912, p. 376, pl. xx, fig. 34.

Occurrence.—Stn. XXV, 17th March, 1929 : in Papuan Pass, 20–25 fath., foraminifera and coral fragments.

Remarks.—A thin incrustation on *Hyatella sinuosa* has a similar spiculation to that described by Hentschel for *Hymedesmia mertoni*. It differs in the absence of the larger sigmata, and of the smaller chelae, and in having longer tornota, measuring up to ·16 mm. long. The larger acanthostyli, too, measure no more than ·14 mm. These differences are, however, of doubtful importance.

H. mertoni is evidently the post-larval form of a species of Myxilleae, and the spicular characters at such a stage are probably subject to a greater variation than at any other stage in the life-history. This I hope to demonstrate shortly in dealing with the post-larval stages of species of sponges from the British Isles. Meanwhile, I propose to regard the present specimen, despite its differences, as a representative of this species.

Distribution.—Malay Area.

Hymedesmia cf. *tenuissima* (Dendy). (Text-fig. 11.)

Myxilla tenuissima, Dendy, 1905, p. 169, pl. xi, fig. 5.

Occurrence.—Stn. XXV, 17th March, 1929 : In Papuan Pass, 20–25 fath., foraminifera and coral fragments.

Remarks.—The specimen forms a thin incrustation on *Thorectopsamma irregularis*, sp. n. The skeleton consists of acanthostyli of two sizes, measuring ·315 and ·07 mm. long respectively, the longer basally-spined, and the shorter entirely-spined, which echinate the surface of the *Thorectopsamma*. Strongylote tornota, measuring ·18 by ·002 mm., are associated with the acanthostyli and disposed usually at right angles to them. The microscleres are chelae arcuatae measuring ·028 mm. chord.

The specimen agrees with *Hymedesmia tenuissima* (Dendy) in general appearance only, but the latter has no long acanthostyli, and its chelae are more robust. Both are probably young forms of a single species in which case the differences between them are unimportant.

Distribution.—Ceylon.

Genus *Paracornulum*, Hallmann.

Paracornulum dubium (Hentschel).

Cornulum dubium, Hentschel, 1912, p. 346, pl. xix, fig. 19; *Paracornulum dubium*, Hallmann, 1920, p. 772.

Occurrence.—Stn. XVIII, 9th March, 1929 : ¼ mile N. of N. Direction Is., 20 fath., sand and thick *Halimeda*.

Distribution.—Aru Island.

Genus *Clathria*, Schmidt.

Clathria, Schmidt, 1862, p. 57; *Echinoclathria*, Carter, 1884, p. 204; *Antherochalina*, Lendenfeld, 1887, p. 786.

Remarks.—Reasons are given under *Echinochalina* (see p. 562) for regarding *Echinoclathria*, Carter, as a synonym of *Clathria*.

The genus *Antherochalina*, Lendenfeld, was founded for the reception of *Veluspa polymorpha*, var. *infundibuliformis*, Maclay, and for 8 new species in addition. In the ordinary course of events the first-named species would be taken as lectotype, but since in this case it is imperfectly known, the first of the new species, *Antherochalina crassa*, is chosen. This species belongs to the genus *Clathria* and *Antherochalina* must accordingly be regarded as a synonym thereof. The remaining species of *Antherochalina* may be identified as follows :

A. elegans = *Syringella elegans* (Lendenfeld).
A. frondosa = *Clathria frondosa* (Lendenfeld).
A. renieroides = *Phakellia flabellata* (Carter).
A. dura = *Phakellia flabellata* (Carter).
A. concentrica = *Phakellia flabellata* (Carter).
A. perforata = *Ophlitaspongia* (*Echinoclathria*) *tenuis* (Carter).
A. tenuispina = *Ophlitaspongia* (*Echinoclathria*) *tenuis* (Carter).

Clathria aculeata, Ridley.

C. aculeata, Ridley, 1884, p. 443, pl. xl, fig. I; pl. xlii, fig. K; Ridley and Dendy, 1887, p. 147.

Occurrence.—Low Isles, the Thalamita Flat, between Porites Pond and North-east Moat, and south of Tripneustes Spit.

Distribution.—Torres Strait.

Clathria rubens (Lendenfeld).

(For synonymy and description see Hallmann, 1912, p. 218.)

Occurrence.—Stns. II and III, 24th November, 1929: Linden Bank, 28 fath., shell and sand. Stn. XVI : ½ mile W. of N. Direction Is., 20 fath., stony. Stn. XVII, 9th March, 1929 : ¼ mile W. of N. Direction Is., 19 fath., sand, thick *Halimeda*. Stn. XIX, 10th March, 1929 : ½ mile N. of Eagle Is., 10 fath., shell, gravel, rich *Halimeda*.

Remarks.—The first specimen is practically identical with that figured by Hallmann (*loc. cit.*, pl. xxxii, fig. 1), but differs in having toxa which rarely, if ever, exceed ·06 mm. in length. The other three have an external form very like that of *Ophlitaspongia subhispida* (Carter) as figured by Hallmann (1912, pl. xxxvi, fig. 1), and a spiculation which may be regarded as intermediate between that of *O. subhispida* and *Clathria rubens*. In order that the spiculation of the first of these species should be derived from the second, all that is necessary is a shortening of the toxa, the loss of the already rare chelae, and the complete suppression of the already rare spines on the accessory styli. These changes are partially realized in the specimens here assigned to *C. rubens*.

From Hallmann's (*loc. cit.*, p. 226) description of *C. transiens*, this species seems to be exactly intermediate between *C. rubens* and *Ophlitaspongia subhispida* in spiculation, while its external form approaches that of the present specimens of *C. rubens*.

In a revision of the species of Clathrieae, it would be necessary, therefore, to consider the possibility that these three species may be synonymous.

Distribution.—Australia (east coast).

Genus *Tenacia*, Schmidt.

Tenacia frondifera (Bowerbank).

Halichondria frondifera, Bowerbank, 1875, p. 288 ; *Amphilectus frondifer*, Vosmaer, 1880, p. 115 ; *Clathria frondifera*, Ridley, 1884, p. 448, pl. xlii, fig. i ; pl. liii, fig. j ; Ridley and Dendy, 1887, p. 149 ; Topsent, 1892, p. 23 ; Lindgren, 1897, p. 480 ; *idem*, 1898, p. 27 ; Dendy, 1905, p. 170 ; Hentschel, 1912, p. 360.

Occurrence.—Stn. IX, 22nd February, 1929 : Penguin Channel, 12–14 fath., sand and thick *Halimeda*.

Remarks.—Although this species has been referred persistently to *Clathria*, it really belongs to *Tenacia*.

Distribution.—Red Sea ; Indian Ocean ; Malay Area ; Australia (north coast).

Tenacia procera (Ridley).

(For synonymy see Dendy, 1921, p. 64, under *Clathria procera*.)

Occurrence.—Stn. XII, 24th February, 1929 : Penguin Channel, 10–15½ fath., rock and shell gravel, mud on edges of pit. Stn. XVII, 9th March, 1929 : ¼ mile N. of N. Direction Is., 19 fath., sand and thick *Halimeda*.

Distribution.—Indian Ocean ; Australia (north coast).

Tenacia paucispina (Lendenfeld).

(For synonymy and description see Hallmann, 1912, p. 178, under *Rhaphidophlus paucispinus*.)

Occurrence.—Stn. XII, 24th February, 1929 : Penguin Channel, 10–15½ fath., rock and shell gravel.

Remarks.—The present specimen consists of a tangled, anastomosing mass of angular and somewhat nodose branches, each 3–5 mm. in diameter. It corresponds more closely in form with the var. *multiporous*, Whitelegge, than with the typical form, but the spicules are quite typical, except that the toxa may occasionally reach a length of ·16 mm.

Distribution.—Australia (east coast).

Tenacia coralliophila (Thiele).

Rhaphidophlus coralliophilus, Thiele, 1903, p. 959, fig. 25.

Occurrence.—Low Isles, the Thalamita Flat.

Remarks.—The single specimen forms a low, irregularly-massive incrustation, and was named by its collectors the " red, conical sponge ". The dimensions of the spicules are: Stout styli, ·36 by ·012 mm.; large subtylostyli, ·56 by ·012 mm.; small subtylostyli, ·26 by ·007 mm.; acanthostyli, ·14 mm. long; chelae ·016 mm. and toxa ·06–·2 mm. The size of the various categories of spicules varies a good deal, and intermediate forms between the styli and the two kinds of subtylostyli appear to be common.

Distribution.—Ternate.

Genus *Ophlitaspongia*, Bowerbank.

Ophlitaspongia rimosa (Ridley).

Desmacidon rimosa, Ridley, 1884, p. 609, pl. liii, fig. F; pl. liv, fig. m.

Occurrence.—Low Isles, Inner Ramparts and the Thalamita Flat.

Remarks.—The several specimens are all in the form of low, rounded cushions, with furrowed surfaces, resembling extremely closely the holotype. The colour, in spirit, varies from a pale flesh tint to drab, but in life it was green, brown and scarlet lake.

The occurrence of this species on the Great Barrier Reef is of unusual interest, since this is only the second record of it, the first being from East Africa.

Distribution.—Mozambique, Portuguese East Africa.

Ophlitaspongia eccentrica, sp. n. (Plate I, figs. 8, 9; Text-fig. 12A.)

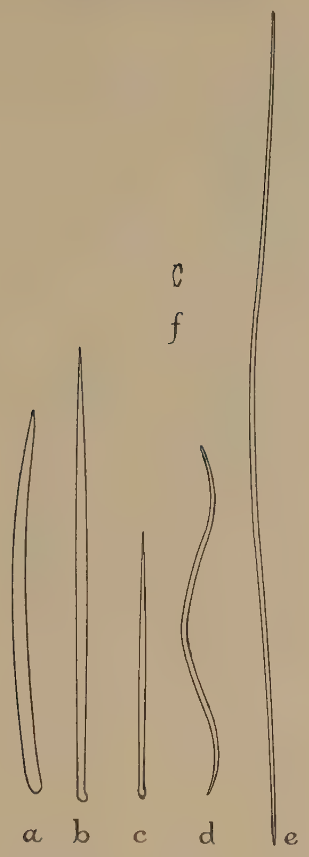
Holotype.—B.M. 30.8.13.109.

Occurrence.—Low Isles, Crab Spit.

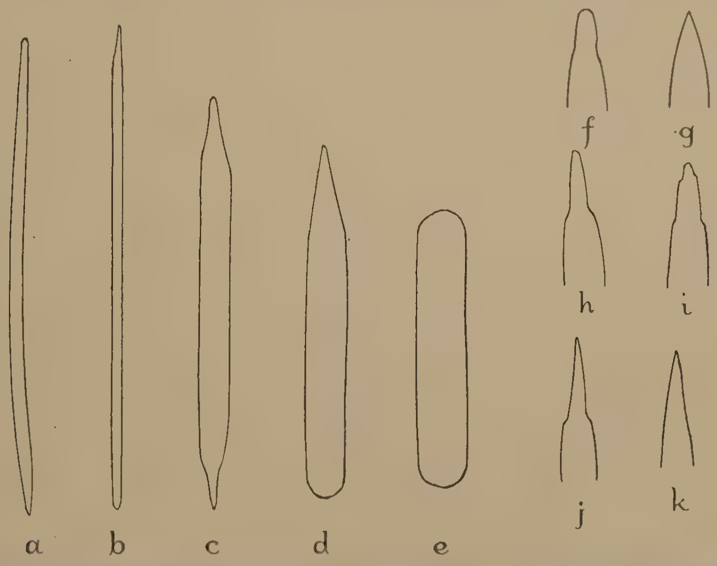
Diagnosis.—Sponge encrusting, massive or irregularly lamellate; skeleton composed of an irregular network of fibres cored by smooth styli, with smooth slender styli of two sizes occurring interstitially; microscleres palmate isochelae and toxa (merging into toxiform oxea ?).

Remarks.—The specimens upon which the diagnosis of this species is based are in a poor state of preservation. Nothing but the skeleton is left, so that it is impossible to describe the external characters apart from the shape. The coring spicules measure ·36 by ·017 mm., the interstitial styli, of two sizes, ·44 by ·008 mm., and ·24 by ·005 mm. Oxea (modified toxa ?) of various sizes, up to ·8 by ·007 mm., occur scattered sparsely in the meshes of the main skeleton, and toxa, up to ·32 by ·004 mm., and chelae, from ·014 to ·018 mm. long, are also present.

The species is peculiar in the presence of oxea, presumably derived by modification from the toxa, and in the differentiation of the auxiliary styli into two distinct sizes.



TEXT-FIG. 12A.—*Ophlitaspongia eccentrica*, sp. n. *a*, Style of main fibres; *b* and *c*, interstitial styli or subtylostyli; *d*, toxote; *e*, toxiform oxeote; and *f*, chela; all × 150.



TEXT-FIG. 12B.—*Protophlitaspongia oxeata*, sp. n. *a*, *b*, oxea; *c–e*, abnormal forms of megascleres; *f–k*, ends of oxea enlarged. *a–e*, × 500; *f–k*, × 1,500.

Protophlitaspongia, gen. n.

Genotype.—*Siphonochalina bispiculata*, Dendy.

Diagnosis.—Clathrieae with skeleton composed of an irregular reticulation of spongin fibres cored by hastately-pointed oxea, with numerous similar spicules scattered in its meshes ; without special dermal skeleton or microscleres.

Remarks.—The affinities of this genus are obscure, and the supposed relationships to the other Clathrieae rest rather on suggested resemblances of the spicules to similar spicules in *Ophlitaspongia* than on any obvious feature. Dendy's (1895, p. 246) description of the skeleton of *Siphonochalina bispiculata* is quite clear and accurate except that there is no dermal skeleton and the spicules scattered in the soft tissues are numerous. His suggestion that "there is a well-developed dermal skeleton composed of radiating tufts of long slender oxea" is incorrect ; these tufts being merely the projecting ends of the spicules coring the main fibres, and not in any sense constituting a special dermal skeleton. The short oxea I do not regard as microscleres since they are connected to the larger spicules by intermediates and resemble them in all respects but size.

Protophlitaspongia oxeata, sp. n. (Text-fig. 12b.)

Holotype.—B.M. 30.8.13.45.

Occurrence.—Stn. XXV, 17th March, 1929 : In Papuan Pass, 20–25 fath., foraminifera and coral fragments.

Diagnosis.—Sponge ramose, branches cylindrical, 3–5 mm. diameter ; surface smooth, even, porose ; texture tough, elastic ; colour, in spirit, light brown ; oscules few, conspicuous, 1–2 mm. diameter, arranged in linear series ; skeleton an irregular reticulation of fibres, in which primary fibres usually contain multiserially-arranged spicules and secondaries are aspiculous or contain a single row of spicules ; numerous spicules scattered between meshes of main skeleton ; spicules hastately-pointed oxea, ·16 by ·004 mm., occasionally modified to styli.

Remarks.—The species differs from the genotype mainly in the external form and in the absence of the small oxea.

Genus *Echinochalina*, Thiele.

Genotype.—*Ophlitaspongia australiensis*, Ridley.

Remarks.—There is a good deal of confusion concerning the genera *Echinochalina*, Thiele, and *Echinoclathria*, Carter, resulting mainly from the errors of Ridley and Dendy, and Hallmann. *Echinoclathria* was proposed by Carter (1884, p. 204), without diagnosis or genotype, but with recognizable descriptions of some unnamed species. The identity of these species is doubtful, but the meagre descriptions of them suggest that the genus *Clathria* would have been more appropriate for their reception. The following year, Carter (1885, pp. 355–7) added four new species to the genus. The first of these, *Echinoclathria tenuis*, here chosen as genolectotype, is a *Clathria*, and, of the remainder, *Echinoclathria nodosa* and *E. subhispida* belong to *Ophlitaspongia*. The fourth, *Echinoclathria* *gracilis*, is congeneric with *Ophlitaspongia australiensis*, Ridley, the genotype of *Echinochalina*, Thiele (1903, p. 961). *Echinoclathria* is therefore a synonym of *Clathria*, but Ridley and Dendy referred to it a number of species rightly belonging to *Echinochalina*. To make matters worse, Hallmann (1912, p. 288) accepted Thiele's genus *Echinochalina*, but amended the diagnosis so as to exclude the genotype. Actually, such action was not only incorrect but quite unnecessary, for *Echinochalina*, in the sense in which Thiele intended it, may be used to include not only the genotype but also those species which Hallmann wished to put in it.

Echinochalina intermedia (Whitelegge).

(For possible synonymy see Dendy, 1921, p. 71, under *Echinoclathria intermedia*.)

Occurrence.—Stn. XVI, 9th March, 1929 : ½ mile W. of N. Direction Is., 20 fath., stony.

Remarks.—The specimen, though of larger size, agrees almost exactly with that described by Dendy (*loc. cit.*). Whether these two are conspecific with the holotype and other specimens recorded from Australia, is, however, a matter of doubt.

Distribution.—Indian Ocean ; Australia (east coast).

Echinochalina anomala, Hallmann. (Plate I, fig. 13.)

Echinochalina anomala, Hallmann, 1912, p. 292, fig. 68.

Occurrence.—Stn. XIX, 10th March, 1929 : ½ mile N. of Eagle Is., 10 fath., shell gravel and rich *Halimeda*.

Remarks.—As the external form of the species has never been illustrated, and is in fact known only from imperfect material, a photograph of the present specimen is given.

Distribution.—Australia (east coast).

Coelocarteria, gen. n.

Genotype.—*Phloeodictyon singaporense*, Carter.

Diagnosis.—Clathrieae with skeleton composed of long oxea, often modified to strongyla, and short strongyla, with minute palmate isochelae for microscleres.

Coelocarteria singaporense (Carter).

Phloeodictyon singaporense, Carter, 1883, p. 326, pl. xiii, fig. 17 ; *Rhizochalina singaporensis*, var., Ridley, 1884, p. 421, pl. xli, fig. s ; *R. singaporensis*, Ridley and Dendy, 1887, p. 34 ; Lindgren, 1897, p. 481 ; *idem*, 1898, p. 297, pl. xix, fig. 11 ; *Histoderma singaporense*, Thiele, 1903, p. 955.

Occurrence.—Stn. XVII, 9th March, 1929 : ¼ mile N. of N. Direction Is., 19 fath., sand and thick *Halimeda* ; Stn. XVIII, 9th March, 1929 : ½ mile S.E. of Lizard Is., 20 fath., shell, gravel and rich *Halimeda*.

Distribution.—Malay Area.

Family Axinellidae.

Genus *Trachyopsis*, Dendy.

Trachyopsis halichondrioides, Dendy.

T. halichondrioides, Dendy, 1905, p. 147, pl. x, fig. 10; Burton, 1926, p. 75, figs. 6–7.

Occurrence.—Stn. XXIV, 13th March, 1929: $\frac{3}{4}$ mile N.E. Pasco Reef, 16½ fath., hard and shell bottom.

Distribution.—Indian Ocean.

Trachyopsis aplysinoides (Dendy).

Halichondria aplysinoides, Dendy, 1921, p. 39, pl. iii, figs. 3–5; pl. xii, fig. 9; *Trachyopsis aplysinoides*, Burton, 1926, p. 78.

Occurrence.—Stn. X, 22nd February, 1929: Satellite Reef, 14–17 fath., coral, shell, gravel and mud.

Distribution.—Indian Ocean.

Genus *Leucophloeus*, Carter.

Leucophloeus fenestratus, Ridley.

L. fenestratus, Ridley, 1884, p. 464, pl. xii, fig. s; *Hymeniacidon fenestratus*, Lindgren, 1897, p. 483; *idem*, 1898, p. 312, p. 124; *nec Leucophloeus fenestratus*, Dendy, 1921.

Occurrence.—Low Isles, Mangrove Park.

Distribution.—Malay Area: Australia.

Genus *Ciocalypta*, Bowerbank.

Ciocalypta penicillus (Bowerbank).

(For synonymy see Topsent, 1921, p. 687.)

Occurrence.—Stn. XVI, 9th March, 1929: ½ mile W. of N. Direction Is., 20 fath., stony.

Distribution.—Eastern Atlantic from N. Europe to S. Africa; Indian Ocean; Malay Area; Australia (all coasts).

Genus *Collŏcalypta*, Dendy.

Collocalypta mertoni (Hentschel).

Ciocalypta mertoni, Hentschel, 1912, p. 424, pl. xiv, fig. 4; pl. xxi, fig. 59.

Occurrence.—Stn. XXIII, 12th March, 1929: Turtle Is., 8 fath., mud and shell.

Distribution.—Aru Is.

Genus *Acanthella*, Schmidt.

Acanthella cavernosa, Dendy.

A. stipitata, Carter, var. Ridley and Dendy, 1887, p. 178; *A. cavernosa*, Dendy, 1921, p. 120, pl. vii, fig. 7; pl. xvii, fig. 3.

Occurrence.—Off North Anchorage, 17th October, 1928, 9 fath. Stn. XII, 24th February, 1929: Penguin Channel, 10–15½ fath., mud and rock. Stn. XXV, 17th March, 1929: In Papuan Pass, 20–25 fath., foraminifera and coral fragments.

Remarks.—The three specimens vary slightly in shape but agree closely in spiculation. One of them is almost identical externally with the holotype of *A. cavernosa*, while the other two resemble *A. vulgata*, Thiele, from Japan. The spiculation in each case is approximately the same as that of *A. cavernosa*.

Since Ridley and Dendy believed their specimen to be very like the type of *A. stipitata*, Carter, a word of explanation is necessary here regarding our knowledge of that species. According to the original description the spiculation of *A. stipitata* consists of styli only, and the species is therefore not a true *Acanthella*. In any case, however, it is so inadequately described as to be practically unrecognizable. *A. stipitata*, Carter, recorded by Dendy (1897, p. 237), is a *Rhaphoxya* and identical with *R.* (*Acanthella*) *cactiformis* (Carter).

Distribution.—Australia (north coast); Indian Ocean.

Genus *Pararhaphoxya*, gen. n.

Genotype.—*P. tenuiramosa*, sp. n.

Diagnosis.—Axinellidae with axial skeleton of flexuous strongyla and curved oxea and styli; with an extra-axial skeleton of oxea; spicules slender and irregularly ended.

Remarks.—The genus combines some characters of both the genera *Phakellia* and *Rhaphoxya*. The skeleton arrangement is the same as in *Phakellia*, and the flexuous strongyla typical of it are present, but the oxea and styli have the same slender character and the same peculiar ends as those of *Rhaphoxya*.

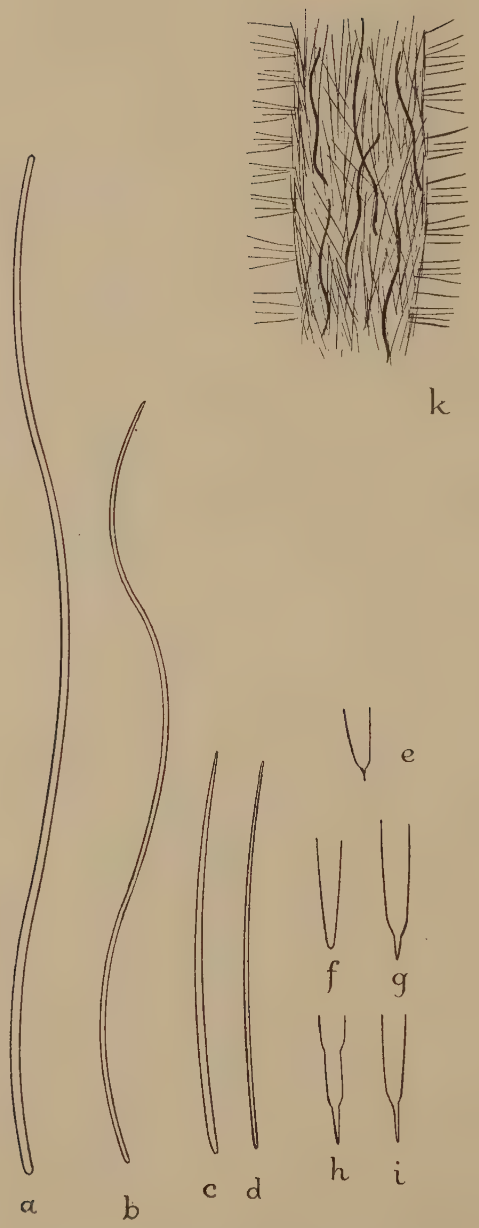
Pararhaphoxya tenuiramosa, sp. n. (Text-fig. 13.)

Holotype.—B.M. 30.8.13.145.

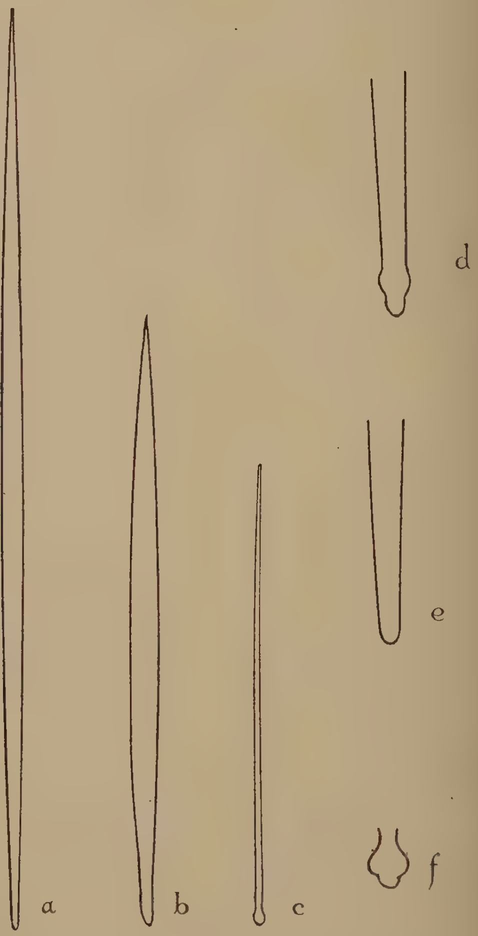
Occurrence.—Stn. XVI, 9th March, 1929: ½ mile W. of N. Direction Is., 20 fath., stony.

Diagnosis.—Sponge stipitate, dichotomously branched; branches slender, maximum diameter 3 mm.; surface hispid; colour, in spirit, greyish-white; oscules small, inconspicuous, distributed over sides of branches; skeleton composed of an axial core of flexuous strongyla, curved oxea and styli arranged longitudinally, and an extra-axial, radially-arranged skeleton of curved oxea; strongyla varying in length and diameter, up to 1·5 mm. long and ·004–·014 mm. in diameter, and oxea and styli up to ·6 by ·006 mm.

Remarks.—The holotype consists of a short stem bearing very slender, regularly dichotomosing branches, rising to a height of 20 cm.



Text-fig. 13.—*Pararaphoxya tenuiramosa*, sp. n. *a*, Flexuous strongyle; *b*, flexuous oxeote; *c* and *d*, styli, × 100; *e–i*, ends of oxea enlarged; *k*, longitudinal section through a branch to show disposition of skeleton, semi-diagrammatic.



Text-fig. 14.—Spicules of *Polymastia megasclera*, sp. n. *a*, Subtylostyle of radial bundles; *b*, subtylostyle of cortical palisade, and *c*, tylostyle of sub-cortical tangential layer, all × 100; *d* and *e*, variations found in the bases of *a* and *b*; *f*, enlarged view of base of *c*.

Family SUBERITIDAE.

Genus *Pseudosuberites*, Topsent.

Pseudosuberites andrewsi, Kirkpatrick.

P. andrewsi, Kirkpatrick, 1900, p. 135, pl. xii, fig. 2; pl. xiii, fig. 7.

OCCURRENCE.—Low Isles, the Thalamita Flat.
DISTRIBUTION.—Xmas Is.

Genus *Laxosuberites*, Topsent.

Laxosuberites proteus, Hentschel.

L. proteus, Hentschel, 1909, p. 389, pl. xxii, figs. 1–3, text-fig. 20–23; Burton, 1930, p. 669.

OCCURRENCE.—Low Isles, the Thalamita Flat.
REMARKS.—The colour of the specimen in life is recorded as gamboge.
DISTRIBUTION.—Australia (south-west coast); Gulf of Manaar.

Genus *Polymastia*, Bowerbank.

Polymastia megasclera, sp. n. (Text-fig. 14.)

HOLOTYPE.—B.M. 30.8.13.155.

OCCURRENCE.—Low Isles, the Thalamita Flat and Mangrove Park.

DIAGNOSIS.—Sponge irregular, low-growing and massive, bearing numerous, irregularly distributed, wart-like papillae on upper surface; texture tough, incompressible; surface even, coarsely pilose; colour, in spirit, brown externally, papillae and choanosome flesh-coloured, cortex white; skeleton composed of radial bundles of long tylostyli, with tylostyli of various sizes scattered profusely in choanosome, a sub-cortical tangential layer of short, slender tylostyli and a cortical palisade of tylostyli of various sizes, but composed mainly of stout, fusiform tylostyli; spicules of three main types, long tylostyli of radial bundles, ·9 by ·02 mm., short, slender tylostyli, varying from ·24 to ·44 by ·008 mm., and stout fusiform tylostyli, ·6 by ·032 mm.

REMARKS.—The holotype is a spreading mass 8 cm. by 6 cm. across by 1 cm. thick, bearing small papillae barely raised above the surrounding surface.

The skeleton is fairly typical, being composed of radial bundles of long tylostyli, with shorter tylostyli scattered between, a tangential layer and a palisade of short tylostyli. The tylostyli scattered in the choanosome are so numerous, so variable in size, and include so many developmental and intermediate forms, that it is not easy to tell precisely how many different types are present. The small slender spicules usually have a well-developed head, often with annular swellings, while annular swellings are commonly found in both the long and slender and in the fusiform tylostyli (*cf.* Text-fig. 14*d*). A second, very small, specimen differs in having a non-pilose surface.

In addition to its peculiar external form, the species differs from all other species in the shape of the fusiform styli which make up the larger part of the cortical palisade.

Family TETHYADAE.

Genus *Tethya*, Lamarck.

GENOLECTOTYPE.—*T. lyncurium*, Lamarck (*fide* Topsent, 1920, pp. 640–646).

Tethya, Lamarck, 1815, p. 69; *Tethia*, Lamarck, 1816, p. 384; *Tethium*, Blainville, 1830, p. 507; *Donatia*, Nardo, 1833, p. 522; *Lyncuria*, Nardo, 1834, p. 715; *Tethea*, Siebold, 1843, p. 363; *Tethyum*, Lieberkühn, 1859, p. 522; *Amniscos*, Gray, 1867, p. 542; *Columnitis*, Schmidt, 1870, p. 25; *Alemo*, Wright, 1881, p. 15.

REMARKS.—Scudder attributes the genus *Tethya* to Oken, who used the name in 1815, but according to Sherborn (Index Animalium) it had already been used by Lamarck.

Tethya robusta (Bowerbank).

(For synonymy see Burton, 1924, p. 1037, under *Donatia robusta*).

OCCURRENCE.—Low Isles, the Thalamita Flat.
DISTRIBUTION.—Indian Ocean; Malay Area; Australia (all coasts).

Tethya japonica, Sollas.

T. japonica, Sollas, 1888, p. 430, pl. xliv, figs. 7–14; *Donatia japonica*, Burton, 1924, p. 1039.

OCCURRENCE.—Stn. XIX, 10th March, 1929: ½ mile N. of Eagle Is., 10 fath., shell gravel.
DISTRIBUTION.—Malay Area; Indian Ocean.

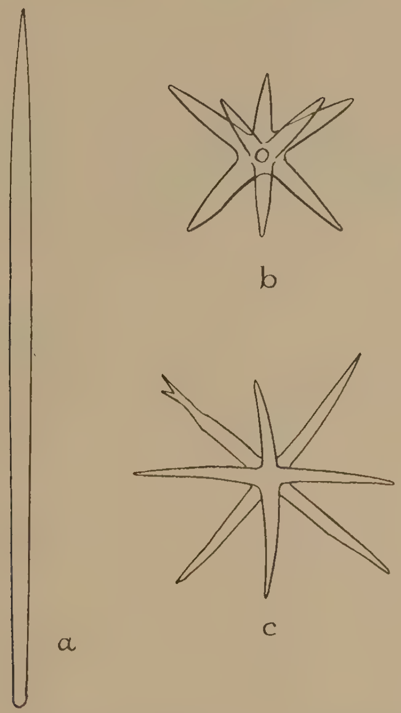
Genus *Tethyorrhaphis*, Lendenfeld.

Tethyorrhaphis oxyaster, sp. n. (Text-fig. 15.)

HOLOTYPE.—B.M. 30.8.13.30.
OCCURRENCE.—Stn. IV, 24th November, 1929: Linden Bank, 38 fath., mud.
DIAGNOSIS.—Sponge of usual form and anatomy; megascleres styli, widest at centre and narrowing gradually to a rounded proximal end, up to 1·12 by ·024 mm.; megasters of 2 sorts, cortical spherasters with slight centrum and 10–12 stout, smooth rays, variable in size up to ·12 mm. in diameter, and choanosomal oxyasters, with smooth, often curved rays, 8–12 in number, without centrum, varying in diameter from ·02–·2 mm.; micrasters absent, but spirasters, often bearing lateral branches and measuring ·018 by ·003 mm. are present.

REMARKS.—The species differs from the only other known species, *T. laevis*, Lendenfeld (see Burton, 1924, p. 1043), in the absence of micrasters, and in the shape and size of the megasters. In all other respects they agree closely. The third microsclere has been called hitherto a microrhabd, on the assumption that the Tethyadae belonged to the Astrotetraxonida. The fact that this microsclere is not a microrhabd but a true spiraster, settles emphatically the much-debated question of the systematic position of the family, which is here placed next to the Clavulidae.

The characteristic feature of the present species, apart from the absence of micrasters, is the presence of two closely similar forms of megaster, the one exclusively cortical and the other choanosomal. A typical cortical megaster has a centrum ·024 mm. in diameter, and the rays are ·012 mm. thick at the base. In the choanosomal megaster there is no centrum, and the rays measure, in the larger examples, ·12 mm. long by ·008 mm. thick at the base.



Text-fig. 15.—Spicules of *Tethyorrhaphis oxyaster*, sp. n. *a*, Style, × 100; *b*, cortical megaster, and *c*, choanosomal megaster, both × 130.

Family Clavulidae.

Genus *Timea*, Gray.

Timea stellata, (Bowerbank).

Hymedesmia stellata, Bowerbank, 1866, p. 150; *idem*, 1874, p. 71, pl. xxviii, figs. 5–8; *Timea stellata*, Gray, 1867, p. 544; *Hymedesmia stellata*, Bowerbank, 1882, p. 67; Topsent, 1900, p. 114, pl. iii, fig. 15; *Stelligera stellata*, Babić, 1922, p. 270, fig. l.

Occurrence.—Stn. XXV, 17th March, 1929: In Papuan Pass, 20–25 fath., foraminifera and coral fragments.

Remarks.—The species is here recorded from extra-European waters for the first time. The specimen, which forms a thin crust on *Thorectopsamma irregularis*, sp. n., is quite typical.

Distribution.—Europe (coasts of British Isles, France and Mediterranean Sea).

Genus *Spirastrella*, Schmidt.

The laudable attempt by Vosmaer (1911) to reduce the number of specific names applicable to the genus *Spirastrella* and to demonstrate that a large number of so-called species are merely growth forms of other species has already been criticized by Topsent (1918) on the grounds that the subordination of specific names was carried too far. It is conceivable that Vosmaer may eventually be proved to have been correct in his action, but, while it cannot be denied that his work was a step in the right direction, the specimens of *Spirastrella* present in the Great Barrier Reef collections suggest that in some respects at least his conclusions require modification. These specimens, to the number of 31, appear to be divisible among three distinct species, and, so far as this collection is concerned, in all cases a particular external form is associated with a definite set of spicular characters. For the time being, therefore, I propose to regard them as representing distinct species without inquiring more closely into the very much wider problem of the fate of the remaining species of the genus.

Of the three species of *Spirastrella* represented on the Great Barrier Reef, two at least may be shown to be boring sponges in the early stages. Certainly the perforation of the coral fragments in which they are found is of a very simple type, and contrasts strikingly with the labyrinthine nature of the canals and chambers of *Cliona*, yet the similarity between the skeletons of *Spirastrella* and *Cliona* suggest that, at the very least, these two genera should not be assigned to different families as has hitherto been the custom.

Spirastrella inconstans (Dendy).

Suberites inconstans, et varr. *maeandrina*, *digitata*, *globosa*, Dendy, 1887, pp. 154–157, pls. ix, x.

Occurrence.—Batt Reef; Low Isles, Crab Spit, Mangrove Park, and between Madrepore Moat and Mangrove Park. Stn. XXII, 11th March, 1929: to E. of Snake Reef, 13½ fath., mud, with foraminifera and shell. Stn. XXIII, 12th March, 1929: in lee of Turtle Is., 8 fath., mud and shell.

Remarks.—Of the twenty specimens assigned to this species, 10 are very like the type of *Suberites inconstans*, var. *globosa*, in external appearance and almost identical with specimens S.E.612d and S.E.98 (of tropus *glaebosa*, Vosmaer, 1911, pl. i, figs. 3–4). The symbiotic barnacles are present in considerable numbers in each specimen, and the skeleton is composed of a coarse-meshed isodictyal network of tylostyli. The microscleres are slender spinispirae* measuring up to ·035 mm. long (even to ·07 in one specimen). Six of the remaining specimens are typical examples of *S. inconstans*, var. *digitata*, having the same type of skeleton as the var. *globosa*, but showing a marked diminution in the number of cirripedes present in the dermal regions. Of the remainder, three are intermediate in form between the varieties *globosa* and *digitata*, but agree in all other respects, except for some variation in the number of cirripedes present.

The last specimen corresponds closely anatomically with all the others, but has the external form of *Spirastrella aurivillii*, var. *excavans*, Lindgren, a single stout papilla perforating coral limestone. From this specimen it appears that *S. inconstans* (Dendy) may pass through a boring stage in early life, and that the whole life-history is similar to that of *Cliona celata* or any other of the typical boring sponges.

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* It is worth mentioning that spinispirae are abundantly present in the type of *S. inconstans*, var. *globosa*, although Dendy failed to remark them.

Distribution.—Indian Ocean.

Spirastrella aurivillii, Lindgren.

S. aurivillii, et varr. *excavans*, *libera*, Lindgren, 1897, p. 484; 1898, p. 40, pl. xvii, fig. 11; pl. xviii, fig. 4; pl. xix, fig. 22.

Occurrence.—Low Isles, the Thalamita Flat.

Remarks.—The five specimens agree with *Spirastrella aurivillii*, var. *excavans*, in all respects and a sixth agrees equally with the var. *libera*. There can, therefore, be little doubt that they represent stages in a boring *Spirastrella* very similar in habitus to *S. inconstans* (Dendy).

Distribution.—Java.

Spirastrella semilunaris, Lindgren.

S. semilunaris, Lindgren, 1897, p. 484; 1898, p. 41, pl. xix, fig. 23.

Occurrence.—Stn. XXII, 11th March, 1929: to east of Snake Reef, 13½ fath., mud, with foraminifera and shells. Stn. XXIII, 12th March, 1929: in lee of Turtle Is., 8 fath., mud and shell.

Remarks.—The four specimens all have the form of S.E.1945 (Vosmaer, 1911, pl. iii, fig. 2) and the spiculation of *S. semilunaris*, Lindgren.

Distribution.—Java.

Comparison of the Main Characters of the Species of Spirastrella *found on the Great Barrier Reef.*

	inconstans.	aurivillii.	semilunaris.
Form	Massive with conspicuous oscules, often digitate with deep cloacae	Boring, with flattened papillae lying almost level with substratum, or digitate. Oscules at ends of papillae	Creeping and agglutinating, incorporating numerous foreign bodies in its substance. Oscules not seen.
Skeleton	Coarse, multispicular, isodictyal	Densely-packed halichondroid	Loosely arranged, mainly scattered spicules.
Megascleres	Slender	Stout	Slender.
Microscleres	Slender, beset with small, wart-like tubercles	Slender, bearing long processes	Stout and short, with conical rays.
Symbionts	Present	Absent	Absent.
Colour, in spirit.	Brick-red usually	Purplish	Brown.

ORDER KERATOSA.

Family SPONGIIDAE.

Genus *Phyllospongia*, Ehlers.

GENOTYPE.—*Spongia papyracea*, Esper.

DIAGNOSIS.—Spongiidae with skeleton of slender pithed fibres, of pale-coloured spongin, arranged in a sub-isodictyal network; without foreign inclusions in fibres and without sandy cortex.

REMARKS.—The genus *Phyllospongia* was originally established by Ehlers (1870, p. 22) for *Spongia papyracea*, Esper, but has gradually undergone corruption until now it is merely a receptacle for all soft-fibred horny sponges of flabellate or cup-shaped form. The major fault lies with Lendenfeld (1889), who treated the genus in the most unconventional way possible, and in order to unravel the present tangle it will be necessary to begin with his work.

Lendenfeld divided the genus into three sub-genera: (1) *Antheroplax*, (2) *Spongionella*, and (3) *Carterispongia*. The first of these was a new name proposed for a group of species which included *Geelongia vasiformis*, Carter, and as *Geelongia* is a valid generic name, and has priority, *Antheroplax* must be considered a synonym of it. *Spongionella* was established by Bowerbank (1866, p. 359) for *S. pulchella*, since re-described by Topsent (1929, pp. 1–12). *Carterispongia* (*errore Carteriospongia*), Hyatt (1877, p. 541), includes, as the first species, *Spongia otahitica*, Esper, which is synonymous with *Spongia foliascens*, Pallas (1766, p. 395). *S. foliascens*, Pallas, is therefore accepted here as the genolectotype of *Carterispongia*, Hyatt. *Spongia papyracea*, Esper, the true type of *Phyllospongia*, is relegated by Lendenfeld to the subgenus *Spongionella* without comment.

The genus *Phyllospongia*, with *Spongia papyracea*, Esper, as genotype, is characterized by a skeleton of slender pithed fibres of pale-coloured spongin which form an irregularly isodictyal skeleton. There are no sandy inclusions in the fibres or in the cortex. The genus *Carterispongia* is without a type-specimen. Pallas's description is fairly complete, but no figure is given, and under these conditions it will be necessary to choose a neotype. For this purpose I take the specimen B.M. 25.11.1.411 from Coin Peros, Indian Ocean. This is practically identical in form with the specimen figured by Lendenfeld (1889, pl. v, fig. 3) under the name *Phyllospongia foliascens*, conforms well to the accepted conception of the species and is from the type-locality. Its skeleton consists of fibres of the same type as those found in *Spongia papyracea*, Esper, but many of them, usually those running vertically to the surface, are cored with sand-grains. The meshes of the skeleton are also much more irregular and there is a sandy layer at the surface. Whether it will be possible to maintain the distinction between *Phyllospongia* and *Carterispongia* remains to be seen, but there is sufficient justification for regarding them as distinct for the time being.

The genus *Mauricea* is very like *Carterispongia*, but the foreign inclusions in the fibres are few and sparsely scattered and there is only a very slight layer of sand at the surface. It may, however, be necessary to unite the two genera.

The genus *Geelongia* may be best described as a *Spongionella*, in which there is a thick sandy cortex and in which the primary fibres are cored by sand.

Actually, *Geelongia* (syn. *Antheroplax*) and *Spongionella* have much in common, while the same may be said of *Carterispongia* and *Phyllospongia*, but these two pairs of genera belong to totally different divisions of the Keratosa. Similarly, the various species included by Lendenfeld under his comprehensive heading of *Phyllospongia* are of a most diverse order, having this only in common, that they are flabellate or cup-shaped in form.

Phyllospongia dendyi, Lendenfeld.

P. dendyi, varr. *frondosa* et *digitata*, Lendenfeld, 1889, p. 177, pl. xiv, fig. 5.

OCCURRENCE.—Batt Reef or Low Isles.

REMARKS.—The present specimen is intermediate between the vars. *frondosa* and *digitata* described by Lendenfeld, and, since these two varieties were founded on unessential characteristics, this subdivision of the species is not accepted here.

DISTRIBUTION.—Australia (west coast).

Genus *Carterispongia*, Hyatt.

GENOLECTOTYPE.—*Spongia foliascens*, Pallas.

DIAGNOSIS.—Skeleton of slender, pithed fibres of pale-coloured spongin arranged in a very irregular network; ascending fibres cored by foreign inclusions; dermis strengthened by a layer of foreign *débris*.

Carterispongia foliascens (Pallas).

Spongia foliascens, Pallas, 1766, p. 395; *Phyllospongia foliascens*, Lendenfeld, 1889, p. 196, pl. v, fig. 3; pl. vi, figs. 1, 3, 4, 10; pl. vii, fig. 11; pl. xiv, fig. 2; pl. xxiv, fig. 6; *Phyllospongia foliascens*, Topsent, 1897, p. 483; *Carteriospongia otahitica*, Keller, 1889, p. 302; (for further synonymy see Lendenfeld, *l. c.*).

OCCURRENCE.—Low Isles and Batt Reef.

DISTRIBUTION.—Red Sea; Indian Ocean; Malay Area; Australia* (all coasts); New Zealand*; Tropical Pacific.*

Carterispongia vermicularis (Lendenfeld).

Phyllospongia vermicularis, Lendenfeld, 1889, p. 201, pl. xv, fig. 5.

OCCURRENCE.—Stn. XIX, 10th March, 1929: about ½ mile N. of Eagle Is., 10 fath., shell, gravel, rich *Halimeda*.

REMARKS.—The single specimen is not in a good state of preservation, which makes its identification a little difficult. It consists of a sub-clathrous mass of branches having the appearance of *Carterispongia vermicularis*, as figured by Lendenfeld (*loc. cit.*). At the same time, the branches in the type measured only 2 mm. in diameter, whereas those of the present specimen measure up to 10 mm. On the other hand, they agree in the structure of the skeleton. Direct comparison is not possible since, although Lendenfeld

* (*Fide* Lendenfeld, *l. c.*)

has indicated its presence in the British Museum collection, careful search has failed to reveal the type-specimen.

DISTRIBUTION.—Australia (west coast).

Carterispongia clathrata (Carter).

Hircinia clathrata, Carter, 1881, p. 366; *Hyatella** *clathrata*, Lendenfeld, 1889, p. 115, pl. xii, figs. 15, 16; pl. xx, fig. 4; *Hircinia clathrata*, Dendy, 1889, p. 96.

OCCURRENCE.—Stn. XXII, 11th March, 1929: E. of Snake Reef, 13½ fath., mud, with foraminifera and shells. Stn. XXIII, 12th March, 1929: Turtle Is., 8 fath., mud and shell.

REMARKS.—This is apparently the first occasion on which specimens of this species preserved in alcohol have been examined, and it is quite evident that the species should not be included in *Hircinia*. Neither the holotype nor Lendenfeld's specimens are available for examination, but as neither Carter nor Lendenfeld mention the presence of filaments, it must be presumed that these are absent, as they certainly are in Dendy's specimens and those from the Barrier Reef.

DISTRIBUTION.—Indian Ocean; Australia; West Indies (*fide* Lendenfeld, *loc. cit.*).

Genus *Spongia*, Linnaeus.

Spongia, Linnaeus, 1759, p. 1348; *Euspongia*, Bronn, 1859, p. 22; *Ditela*, Schmidt, 1862, p. 24; *Hippospongia*, Schultze, 1879, p. 614.

DIAGNOSIS.—Spongiidae with skeleton of pale-coloured, slender spongin fibres, differentiated into primary fibres, running vertically to surface, connected by a complicated and irregular network of secondary fibres free from inclusions.

REMARKS.—Although the Bath sponge was the first to be recognized and named, and is the one most quoted in our literature, it is unusually difficult to choose a specimen which shall represent the type of the species. Since 1758, when Linnaeus first used the name for what is known, in a loose and indefinite way, as the Bath Sponge, the species has been again mentioned by Linnaeus (1767), and by Pallas (1766), Houthuyn (1772), Ellis and Solander (1786), Gmelin (1789) and Esper (1794). In one case only is the specimen assigned to this species now available, namely, that described by Esper, and this was subsequently made the type of *Spongia adriatica*, var. *quarnerensis*, by Ehlers (1870). This specimen is now preserved in the Museum at Erlangen. The position is rendered more complicated by the fact that all authors subsequent to Esper have given either a casual reference to the species only, or have assigned the specimens before them to one or other of the numerous varieties of the species now recognized. Under the circumstances, it seems that no one specimen can be said more than any other to represent that elusive animal, the Bath Sponge, and no one can be regarded, more than any other, as the type of the species. One of two alternatives must therefore be adopted: either to abandon the name altogether or choose a neotype. The first is inadvisable as the name is so well-known, and, as regards the second course, the obvious thing would be to select Esper's specimen as the neotype. Since, however, accessibility for examination is an important factor, and there are obvious difficulties in the way of this if Esper's specimen be chosen, and as a matter purely of convenience, I select a specimen named by Schulze, *S. officinalis*, var. *adriatica*, and deposited in the British Museum (No. 83.12.4.28) as the neotype of *S. officinalis* and the lectotype of var. *adriatica*. The var. *adriatica* becomes therefore the typical variety of *S. officinalis*.

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* The genus *Hyatella* was established by Lendenfeld (1889, p. 102) who diagnosed it: Aulenidae which consist of a reticulating lamella with large vestibular cavities, which are more extensive than the septa between them. The thicker connecting fibres of the skeleton are over 0·03 mm. thick. The meshes of the skeleton net over 0·2 mm. wide. Mostly hard and incompressible sponges.

This diagnosis does not contain a single feature by which the genus could be recognized with any degree of certainty. Nor is it possible to glean, from the characters of the various species assigned to it, what Lendenfeld's conception of the genus may have been, since these are all inadequately described and the few of them that can be recognized, or are available for examination, belong obviously to several different genera. When we come to the question of the genotype, the situation is no better. Lendenfeld says (*l. c.*, p. 102): "The first described sponge referable to this genus is the *Spongia sinuosa* of Pallas . . ." This leaves little doubt as to what he considered to be the type of the genus, but, unfortunately, although several authors have identified sponges with *Spongia sinuosa*, Pallas, I fail to see any possibility of recognizing this species.

Pallas's description of *Spongia sinuosa* reads: "Incrustat varia corpora, semipollicari circiter strato; interna crustae facies poris coecis inaequalibus sparsa, exterior cavitatibus majusculis, oblongis vel cotyloideis, confertissimis obsita. *Substantia* tenaciuscula, mollis, griseo-flavescens, ex fibris maxime perpendicularibus, per creberrimas anastomoses tenerioresque fibrillas contextis, facta. Crustarum margo tenuiter veli instar diffunditur & sensim crassescit atque cavernosus fit. *Odor* combustae animalis. *Locus:* Oceanus Indicus?"

It is impossible to recognize anything by this! The genus must therefore be treated as unrecognizable and the use of the name *Hyatella* abandoned.

The neotype thus chosen has a skeleton conforming with the accepted ideas of the diagnosic features of the species *S. officinalis*, and expressed in the diagnosis of the genus *Spongia* given above. There can therefore be little objection to accepting this specimen as the type of the species, and, on the other hand, there is great advantage to be gained, in that, for the first time in its history, the species is placed on a definite and stable basis.

A similar difficulty is encountered in determining the type of *Hippospongia*. This genus was established by Schulze (1879, p. 614) for *Spongia equina*, Schmidt (1862, p. 23), and the original specimen (or specimens ?) is, so far as may be ascertained, not to be found. Under the circumstances, I choose a specimen in the British Museum, agreeing very closely in external characters with that figured by Schulze (*loc. cit.*, pl. xxxv, fig. 14). This has a skeleton agreeing in all respects with that of the neotype of *Spongia officinalis*. The genera *Spongia* and *Hippospongia* must thus be regarded as synonyms. This is an eminently satisfactory conclusion as no author in the past seems to have been sure of the exact value of the two genera.

Thus, it is not unusual to find a species placed first in *Spongia* (= *Euspongia*) and then in *Hippospongia* (*cf.* Lendenfeld, 1889, pp. 300–325, where this is well illustrated). In other cases, one species has been consistently placed in *Spongia*, while another species, which in actual fact is at most only varietally distinct from it, has been as consistently placed in *Hippospongia*.

The only attempt made to diagnose and compare the two genera under discussion is that contained in Lendenfeld's Monograph (1889, pp. 245 and 280). Here the genus *Euspongia* (= *Spongia*) is diagnosed: "Massive Spongidae with distinct main, and branched, continually anastomosing connecting fibres. The meshes of the connecting fibre net are mostly under 0·04 mm. wide. The surface is conulated and destitute of a dense cortex. Vestibular cavities absent or small." The genus *Hippospongia* is diagnosed: "Spongidae consisting of reticulate lamellae between which extensive vestibular lacunae are situated. These are wider than the septa between them and are thick. The connecting fibres form a network with meshes 0·1–0·4 mm. wide. The dry skeletons of the wide-meshed species are soft and elastic."

The first expresses the usually accepted conception of the genus *Spongia*, in so far as this could hitherto have been defined, and the latter is quite clearly based on Schulze's figure of *Hippospongia equina* (Schmidt). After due allowance is made for the obvious defects in the construction of Lendenfeld's diagnoses, we are left with the impression that the only difference between *Spongia* and *Hippospongia* is the more cavernous design of the internal skeleton of the latter, and this, far from being of generic importance, is a character of doubtful value in the determination even of varieties or of a species. How little Lendenfeld was guided by his own diagnoses is shown by a casual examination of the species he assigns to the two genera.

The name *Euspongia* was proposed by Bronn (1859, p. 22) to replace *Spongia*, but no explanation was given either then or subsequently, by this or any other author, as to the reason for such a change, although it has been almost universally accepted. So far as may be judged, the objection to using the name *Spongia* lies in the fact that it means literally a sponge, and that we can no more have this than we could have a genus of birds named *Aves*. If that were so, then it is impossible to imagine that the case is met by rejecting a name meaning "a sponge" and substituting one meaning "a true sponge", and since it is contrary to accepted procedure to change a name once given, I propose to revive the use of the word *Spongia*. Vosmaer's suggestion, that "Es ist zweifelsohne besser den Namen *Spongia* fallen zu lassen, da er für sehr verschiedene Schwämme in Anwendung gebracht ist", is indefensible.

Ditela, Schmidt (1862, p. 24, pl. ii, fig. 6), with genotype *D. nitens*, is also a synonym of *Spongia*, as shown by a preparation in the British Museum collection, from the type. The secondary reticulation figured by Schmidt is formed, obviously, by the dried strands of sarcode.

Spongia officinalis, Linnaeus.

OCCURRENCE.—Mangrove Park, Low Isles and Batt Reef.

REMARKS.—Judging by the range in form shown by the numerous specimens of commercial sponges in the British Museum collection, including between 400 and 500 individuals presented to the British Museum by Mr. L. R. Crawshay, it seems probable that we shall ultimately recognize one species only, *S. officinalis*, and that this species will be divisible into a number of ill-defined tropi, like those of *Spirastrella purpurea*, recognized by Vosmaer (1911). Since, however, it is hoped that Mr. Crawshay will soon publish his observations on the sponges of the West Indies and since an opinion on this material can only realize its greatest value in conjunction with observations made in the field, I do not propose to consider the Crawshay collection any further here.

The Barrier Reef specimens here assigned to *S. officinalis* are of two forms, which I propose to call α and β respectively. The first, represented by numerous specimens, is spherical or subspherical in form with numerous oscules on the upper surface, and the second is represented by a single bi-ridged specimen.

Form *α* (= *Euspongia irregularis*, var. *pertusa*, Lendenfeld, see Stephenson, 1931) resembles closely in form and texture the Bahamas Reef Sponge and is, in my opinion, not even varietally distinct from it. It is, moreover, identical with *E. officinalis*, var. *ceylonensis*, Dendy, *E. trincomaliensis*, Lendenfeld, and *E. officinalis*, var. *arabica*, Keller.

Form *β* approximates closely, in surface structure and texture, to the West Indian Grass Sponge (= *Hippospongia equina* (Schmidt)), but in form agrees very nearly with *Hippospongia canaliculata*, Lendenfeld. There is, too, a resemblance to the Cuban Hard Head (= *H. equina*). On the other hand, except in form, it does not differ greatly from form *α*, and is obviously congeneric with it and certainly conspecific even when judged by the standard set in Lendenfeld's monograph.

From the Crawshay collections referred to above, it seems certain that the variability of the form in commercial sponges is far greater than has been hitherto suspected, in which case the Australian sponge is identical with the West Indies form. This connection between the faunas of Australia and West Indies has been commented on elsewhere (p. 514).

Distribution.—Australia ; Indian Ocean ; Malay Area ; West Indies.

Spongia nardorus (Lendenfeld).

Aphrodite nardorus, Lendenfeld, 1886, p. 306, pl. xxxv, figs. 24–26 ; *Hippospongia aphroditella*, *idem*, 1889, p. 312, pl. xi, figs. 11–14 ; pl. xii, fig. 13 ; *Ceratodendron haeckelii*, Marshall, 1892, p. 5, pls. ii, iii, pl. vi, figs. 8–15 ; pl. vii, fig. 1.

Occurrence.—Stn. XIX, 10th March, 1929 : about ½ mile N. of Eagle Is., 10 fath., shell, gravel, rich *Halimeda*. Stn. XXI, 11th March, 1929 : ½ mile N.W. of Howick Is., 10 fath., mud and shell, foraminifera. Stn. XXII, 11th March, 1929 : E. of Snake Reef, 13½ fath., mud, foraminifera, and shell. Stn. XXIII, 12th March, 1929 : in lee of Turtle Is., 8 fath., mud and shell

Distribution.—Australia (Torres Straits and Bass Straits).

Thorectopsamma, gen. n.

Genotype.—*T. irregularis*, sp. n.

Diagnosis.—Spongiidae with laminated fibres completely filled with sand-grains, or other foreign matter ; skeleton a regular reticulation of quadratic mesh, with secondary fibres only slightly smaller than primary fibres ; spongin dark-coloured ; no special dermal skeleton.

Remarks.—The genus appears to be closely related to *Thorecta*, *Thorectandra* and *Spongionella*, and is accordingly placed in the family *Spongiidae* following the usage of Lendenfeld (1889). The characteristic feature of *Thorectopsamma* is that all fibres are densely packed with sand-grains, whereas in the three genera mentioned the fibres contain either no foreign matter at all, or a line of sand-grains coring the primary fibres only.

Thorectopsamma irregularis, sp. n.

Holotype.—B.M. 30.8.13.217.

Occurrence.—Stn. XXV, 17th March, 1929 : In Papuan Pass, 20–25 fath., foraminifera and coral fragments.

Diagnosis.—Sponge irregularly massive; surface conulose, conuli 1 mm. high and 1–2 mm. from each other; oscules not seen; colour, in spirit, black on upper parts, shading to drab below; meshes of skeleton ·6 to 1·6 mm. across, primary fibres ·2 mm. thick, secondary fibres ·12 mm. thick.

Remarks.—There is nothing remarkable about the external form of this species, but the skeleton is interesting. The fibres are so densely charged with sand-grains that in most places it is impossible to determine their structure. At several points, however, the fibre is, for a short interval, free of inclusions and the laminated character becomes visible, and this, and the regularity of the skeleton as a whole, suggests that *Thorectopsamma* is a *Thorecta* in which the whole of the fibre is filled with foreign matter.

Genus *Hircinia*, Nardo.

Genolectotype.—*I. spongiastrum*, Nardo.

Ircinia (vel Jrcinia), Nardo, 1833, col. 521; *Hircinia*, Nardo, 1834, p. 714; *Stematumenia*, Bowerbank, 1845, p. 406; *Filifera*, Lieberkühn, 1859, p. 370; *Sarçotragus*, Schmidt, 1862, p. 35; *Polytherses*, Duchassaing and Michelotti, 1864, p. 67; *Euricinia*, Lendenfeld, 1889, p. 554; *Hircinella*, *idem*, *l. c.*, p. 564; *Dysidicinia*, *idem*, *l. c.*, p. 565; *Psammocinia*, *idem*, *l. c.*, p. 579.

Diagnosis.—Spongiidae with skeleton of pithed fibres differentiated into primary fasciated systems of fibres, often filled with foreign inclusions, connected by transverse or irregularly-disposed secondary fibres; interstices of skeleton filled to a greatly varying extent with "filaments".

Remarks.—The genus *Ircinia* was established by Nardo (1833) for *I. spongiastrum* and three other species, the types of which appear to be lost; but the original diagnosis of the genus leaves no doubt that it was intended for those sponges with a horny skeleton, the larger fibres of which are fasiculated, and spongin filaments. The genera *Filifera*, Lieberkühn, and *Stematumenia*, Bowerbank, the descriptions of which are accompanied by figures, must therefore be regarded as identical with it. Later, Nardo (1834, p. 714) altered the spelling to *Hircinia*, which is classically more correct, and since this form has been accepted by subsequent authors, there is no reason why it should not continue to be used.

The following names fall into synonymy with *Hircinia*: *Polytherses*, Duchassaing and Michelotti, and *Euricinia*, *Hircinella*, *Dysidicinia* and *Psammocinia*, all of Lendenfeld. In spite of the absence of filaments from the genoholotype, *Sarcotragus*, Schmidt, must also be so treated (*cf. I. dendroides*, p. 580).

Hircinia irregularis (Poléjaeff).

Cacospongia irregularis, Poléjaeff, 1884, p. 63, pl. vi, fig. 10; pl. viii, fig. 5; *Hircinia gigantea*, Lendenfeld, 1889, p. 588, pl. xxvii, fig. 7; pl. xxviii, fig. 2; pl. xxxvi, figs. 1, 6, 10.

Occurrence.—Stns. II and III, 24th November, 1928: Linden Bank, 28 fath., shell and sand. Stn. XIX, 10th March, 1929: about ½ mile N. of Eagle Is., 10 fath., shell, gravel, rich *Halimeda*.

Remarks.—The specimens agree closely with the holotype in all respects. Those recorded from Port Jackson as *Hircinia gigantea*, which are now in the British

Museum collection, are conspecific with *H. irregularis* (Poléjaeff), but they are much larger and have more prominent conules.

Distribution.—Australia (north and east (?) coasts).

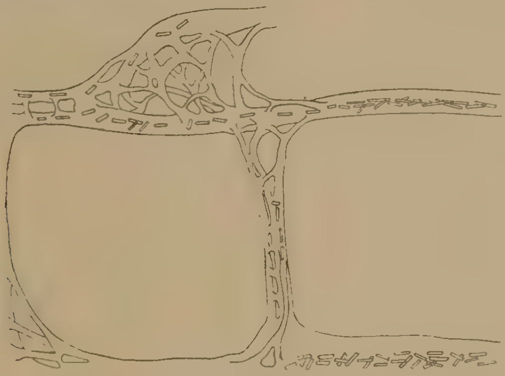
Hircinia echinata, Keller.

H. echinata, Keller, 1889, p. 347, pl. xxi, fig. 13; *H. variabilis*, var. *hirsuta*, Row, 1911, p. 372.

Occurrence.—Stn. XIX, 10th March, 1929: about ½ mile N. of Eagle Is., 10 fath., shell, gravel, rich *Halimeda*.

Remarks.—A sub-spherical specimen, 11 cm. in diameter, agrees closely with Keller's description of *H. echinata*. The present specimen is conspecific with Row's *Hircinia variabilis*, var. *hirsuta*, from the Red Sea, of which I have examined the type. The identity of *H. variabilis*, var. *hirsuta*, with *H. echinata*, Keller, would thus appear to be well established, although not checked by comparison with the type-specimen of the latter.

Distribution.—Red Sea.



Text-fig. 16.—*Hircinia ramosa*, Keller. Section at right angles to surface. × 52.

Hircinia ramosa, Keller. (Plate I, fig. 11; Text-fig. 16.)

H. ramosa, Keller, 1889, p. 345, pl. xx, fig. 5; Row, 1911, p. 372.

Occurrence.—Stn. XIX, 10th March, 1929; ½ mile N. of Eagle Is., 10 fath., shell, gravel, rich *Halimeda*.

Remarks.—The specimen agrees closely with the holotype and with Row's specimen.

Row's observation that the skeleton of his specimen "is quite free from foreign bodies" is wrong. Spicule fragments are present in the fibres, but not in such numbers as in the Barrier Reef specimen. Text-fig. 16 shows the peculiar clathrous structure commonly seen in both primary and secondary fibres.

Distribution.—Red Sea.

Hircinia pinna, Hentschel.

H. pinna, Hentschel, 1912, p. 443, pl. xv, fig. 4; pl. xvi, fig. 5.

Occurrence.—Stns. II and III, 24th November, 1928: Linden Bank, 28 fath., shell and sand.

Distribution.—Aru Island.

Hircinia aruensis, Hentschel.

H. aruensis, Hentschel, 1912, p. 445, pl. xvi, fig. 6.

Occurrence.—Stn. XXIV, 13th March, 1929 : $\frac{3}{4}$ mile N.E. of Pasco Reef, 16½ fath., hard and shelly bottom.

Distribution.—Aru Island.

Hircinia ramodigitata, sp. n. (Plate I, fig, 12 ; Text-fig. 17.)

Holotype.—B.M. 30.8.13.219.

Occurrence.—Stn. XII, 24th February, 1929 : Penguin Channel, 10–15½ fath., rock and shell gravel.

Diagnosis.—Sponge ramo-digitate ; surface conulose ; oscules few, 2 mm. diameter, dispersed ; texture compressible ; colour, in spirit, drab ; skeleton a reticulation of primary and secondary fibres ; primary fibres simple, cored with sand-grains and sponge spicules ; secondary fibres simple or forming an irregular network, rarely containing foreign inclusions ; filaments absent ; dermis containing a reticulation of polygonal mesh formed of sand and spicules.

Remarks.—The external form of the species is shown sufficiently well on Plate I, fig. 12, to obviate the need for further description, and Text-fig. 17 gives a tolerably clear idea of the structure of the skeleton. The distance between adjacent primary fibres is variable within fairly wide limits, making the surface conuli irregular in distribution. The secondary fibres may be simple, or may form an irregular network by branching and anastomosis. Foreign inclusions are confined almost entirely to the primary fibres, only an occasional sand-grain or piece of spicule being found in the secondaries. The primary fibres average ·096 mm. thick and the secondaries ·048 mm. Filaments are absent, but the choanosome is filled with a filamentous alga which simulates the appearance of the "*Hircinia*-filaments".

There is no well-marked dermal skeleton, but the dermis contains a polygonal reticulation of sand-grains and fragments of spicules which, in some places at all events, appear to be held in place by a coating of spongin of so pale a colour as to be almost inappreciable.

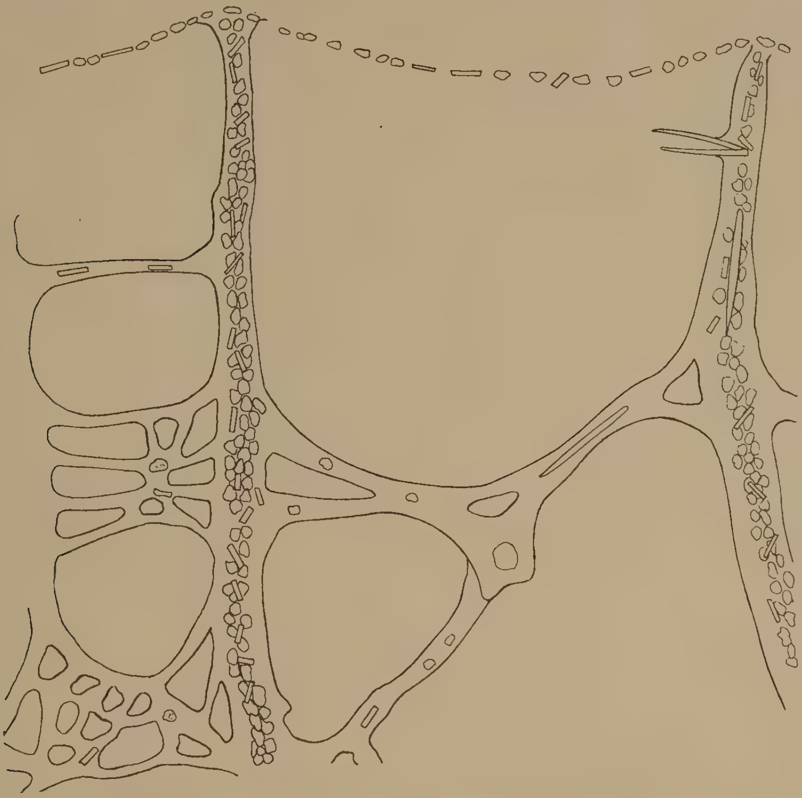
Although filaments are absent, the species has been assigned to *Hircinia* owing to its likeness in all other respects to *H. variabilis* (Schulze). In external form and the structure of the fibres of the skeleton, the holotype of *H. ramodigitata*, sp. n., is singularly like a specimen of *H. variabilis* from Trieste, B.M. 83.12.4.23, identified by Schulze, but the sand in the dermis in Schulze's specimen is not arranged in a reticulation as in the present species, and the secondary fibres form a more clearly marked network.

Hircinia dendroides (Poléjaeff).

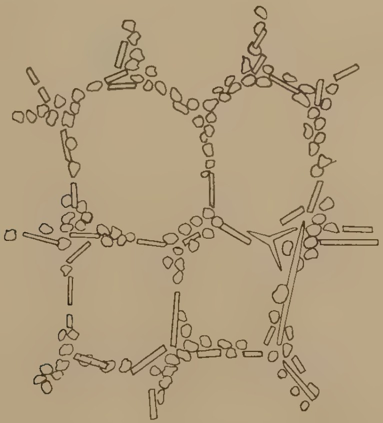
C. dendroides, et varr. *dura, friabilis*, Poléjaeff, 1884, p. 60, pl. viii, figs. 1–3 ; pl. vi, fig. 14 ; *Hircinia schulzei*, Dendy, 1905, p. 221, pl. xvi, fig. 3.

Occurrence.—Stn. X, 22nd February, 1929 : Satellite Reef, 14–17 fath., coral, shell, gravel and mud. Stn. XXI, 11th March, 1929 : ½ mile N.W. of Howick Is., 10 fath., mud and shell. Stn. XXIII, 11th March, 1929 : Turtle Is., 8 fath., mud and shell. Stn. XXV, 17th March, 1929 : Papuan Pass, 20–25 fath., foraminifera and coral fragments.

Stn. XXVII, 18th March, 1929 : Papuan Pass, 17 fath., coarse sand. North Anchorage, 17th October, 1928 : 9 fath.



TEXT-FIG. 17*a*.—*Hircinia ramodigitata*, sp. n. Section at right angles to surface. × 70.



TEXT-FIG. 17*b*.—*Hircinia ramodigitata*, sp. n. Section tangential to surface, showing network of sand-grains and foreign spicules. × 70.

REMARKS.—The two varieties of this species recognized by Poléjaeff differ in two details only ; in var. *friabilis* the fibres are filled with coarse *débris*, chiefly sand, and the dermis contains an even layer of similar material, and in var. *dura* the fibres contain only extraneous siliceous spicules and the dermis is without foreign inclusions of any sort. Of the five specimens in the present collection, four agree in skeleton with the type of var. *dura* and one with var. *friabilis*. On the other hand, the one specimen agreeing with the var. *friabilis* in skeleton is identical with the var. *dura* in external form, and those agreeing with the var. *dura* in skeleton approximate closely to var. *friabilis* in external features. It seems probable, therefore, that the differences between the two varieties are of less significance than even Poléjaeff supposed. Possibly it is that the character of the material enclosed within the fibres of a given individual is determined by the nature of the substratum. The evidence in the present instance is not conclusive in this respect, however, since of the four containing only siliceous spicules, one was growing on a mixture of coral, shell, gravel and mud, another on a mixture of mud and shell *débris*, and the third on coarse sand. The nature of the bottom on which the fourth was growing is not known. In each of the first three there would appear to be considerable opportunity for the inclusion of sand-grains, as in the var. *friabilis*, but this has not taken place. Perhaps it is that local variations in the nature of the substratum, of which we are not aware, may be responsible for this anomaly. Each one of these individuals bears unmistakable evidence of having grown on large fragments of calcareous *débris*, chiefly coral, and shows no sign of contact with a muddy or sandy substratum. The one individual corresponding to the var. *friabilis* contains, on the other hand, considerable quantities of foreign inclusions corresponding to those forming the substratum, viz. chiefly the remains of foraminifera and small calcareous particles, with a sprinkling of quartz-grains and a few foreign spicules, so that here at least there is some correlation between the nature of the substratum and the type of material included by the sponge in its fibres.

Each of the present specimens contains some filaments, but the numbers present vary considerably, and in one specimen they are so rare as to be virtually absent. It is not difficult to conceive of their being entirely absent in some individuals, and we are compelled to regard the presence or absence of these filaments as a character of doubtful taxonomic value.

Hircinia schulzei, Dendy, is quite evidently identical with this species, while *Hippospongia frondosa*, Hentschel (1912, p. 435), has a great deal in common and may be identical with it.

DISTRIBUTION.—Malay Area ; Indian Ocean.

Genus *Dysidea*, Johnston.

Duseideia, Johnston, 1842, p. 185 ; *Dysidea*, Johnston, 1842, p. 251 ; *Dysidia*, Agassiz, 1846, p. 131 ; *Spongelia*, Nardo, 1847, p. 3 ; *Dysceideia*, Lieberkühn, 1859, p. 363 ; *Duseidea*, Delage and Hérouard, 1899, p. 230.

DIAGNOSIS.—Spongiidae with skeleton normally composed of a reticulation of primary and secondary fibres, usually entirely filled with foreign inclusions.

REMARKS.—Johnston (1842, p. 185) established the genus *Duseideia*, but later in the same work (p. 251) altered the spelling to *Dysidea*. Since there is no rule as to which name shall be used, and as the second spelling is in accordance with the recommendations of the International Commission on Nomenclature, and with the standard practice of transliteration (or transcription), the name *Dysidea* is accepted here.

The genus *Dysidea* corresponds to *Spongelia*, as used by the majority of authors ;

but this name actually post-dates *Dysidea*. The genus *Spongelia* was established by Nardo in 1834 (p. 714) without diagnosis, and without having any species assigned to it. In 1847 (p. 3), Nardo refers to the species *Spongelia elegans*, which was subsequently re-described by Schmidt (1862, p. 28, pl. iii, fig. 5); and as it is probable that Schmidt had access to Nardo's types, *S. elegans* is here accepted as the genotype of *Spongelia*, in which case the name *Spongelia* must date from 1847.

Dysidea fragilis (Montagu). (Plate II, figs. 2–11; Text-figs. 18–33.)

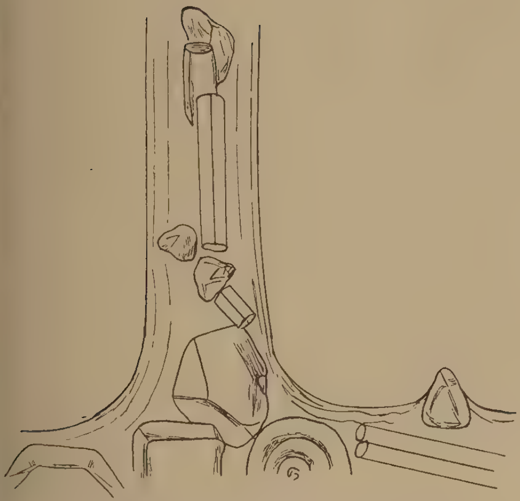
Spongia fragilis, Montagu, 1818, p. 114, pl. xvi, figs. 1, 2; Gray, 1821, p. 360; Fleming, 1828, p. 526; Templeton, 1836, p. 471; *Duseideia fragilis*, Johnston, 1842, p. 187; pl. xiii, fig. 6; pl. xiv, fig. 4; *Spongelia fragilis*, Nardo, 1847, p. 3; *Spongia tupha*, Lieberkühn, 1859, p. 358; *Spongelia elegans*, Schmidt, 1862, p. 28, pl. iii, fig. 5; *S. avara*, *idem*, *l. c.*, p. 29, pl. iii, fig. 6; *S. incrustans*, *idem*, *l. c.*, p. 29, pl. iii, fig. 7; *S. pallescens*, *idem*, *l. c.*, p. 30, pl. iii, fig. 8; *S. pallescens*, Schmidt, 1864, p. 28; (?) *S. fistularis*, *idem*, *l. c.*, p. 28, pl. ii, figs. 28, 29; pl. iii, fig. 4; (?) *S. perforata*, *idem*, *l. c.*, p. 28; *Dysidea fragilis*, Bowerbank, 1864, p. 211, pl. xiv, figs. 270–272; *Spongelia elegans*, Kölliker, 1864, p. 66; *Dysidea fragilis*, Bowerbank, 1866, p. 381; *Spongelia fragilis*, Schmidt, 1870, p. 77; *Dysidea fragilis*, Bowerbank, 1874, p. 175, pl. lxix, figs. 1–3; *D. coriacea*, *idem*, *l. c.*, p. 341, pl. xci, fig. 20; D. *fragilis*, Carter, 1876, p. 232; *Spongelia pallescens* subsp. *fragilis* varr. *incrustans*, *tubulosa*, *ramosa*, subsp. *elastica* varr. *massa*, *lobosa*, Schulze, 1879, p. 138, pl. v, figs. 1–4; pl. vi, figs. 2–3, 5–7; *S. elegans*, *idem*, *l. c.*, p. 151, pl. v. fig. 5; *S. avara*, *idem*, *l. c.*, p. 127, pl. vi, figs. 1, 4; pl. viii, figs. 1–7, 13, 14; *S. spinifera*, *idem*, *l. c.*, p. 152, pl. v, fig. 6; pl. vi, figs. 8–10; *Dysidea fragilis*, Bowerbank, 1882, p. 188; *D. coriacea*, *idem*, *l. c.*, p. 189; *Spongelia pallescens*, Poléjaeff, 1884, p. 42, pl. iii, fig. 1; *Dysidea fragilis*, Carter, 1885, p. 215; *D. cinerea*, Keller, 1889, p. 337, pl. xx, fig. 2; *D. nigra*, *idem*, *l. c.*, p. 338; *Spongelia spinifera*, Lendenfeld, 1889, p. 653; *S. elegans*, *idem*, *l. c.*, p. 655, pl. xxxix, fig. 2; *S. elastica*, *idem*, *l. c.*, p. 657; pl. xxxviii, fig. 8; pl. xliii, fig. 7; *S. elastica*, var. *massa*, *idem*, *l. c.*, p. 658, pl. xliii, fig. 7; *S. elastica* var. *lobosa*, *idem*, *l. c.*, p. 659; pl. xxxviii, fig. 8; *S. fragilis*, *idem*, *l. c.*, p. 660, pl. xxxvii, fig. 10; *S. fragilis* var. *irregularis*, *idem*, *l. c.*, p. 662, pl. xxxvii, fig. 10; *S. fragilis*, var. *incrustans*, *idem*, *l. c.*, p. 664; *S. fragilis*, var. *tubulosa*, *idem*, *l. c.*, p. 665; *S. avara*, *idem*, *l. c.*, p. 667, pl. xliii, figs. 3, 4, 6; *S. fragilis* var. *ramosa*, Dendy, 1905, p. 208; *S. elastica* var. *lobosa*, *idem*, *l. c.*, p. 208; *S. elastica* var. *crassa*, *idem*, *l. c.*, p. 209; *Dysidea cinerea*, Row, 1911, p. 365; *Spongelia spinifera* var. *australis*, Hentschel, 1912, p. 446; *S. fragilis* var. *clathrata*, *idem*, *l. c.*, p. 447; *S. fragilis* var. *ramosa*, Dendy, 1916, p. 139; *S. cinerea*, *idem*, *l. c.*, p. 140; *S. elegans* var., *idem*, *l. c.*, p. 140.

OCCURRENCE.—Stn. X, 22nd February, 1929: Satellite Reef, 14–17 fath., coral, shell, gravel and mud. Stn. XVII, 9th March, 1929: $\frac{1}{4}$ mile north of N. Direction Is., 19 fath., sand and thick *Halimeda*. Stn. XXIV, 13th March, 1929: $\frac{3}{4}$ mile N.E. of Pasco Reef, 16$\frac{1}{2}$ fath., hard and shell bottom.

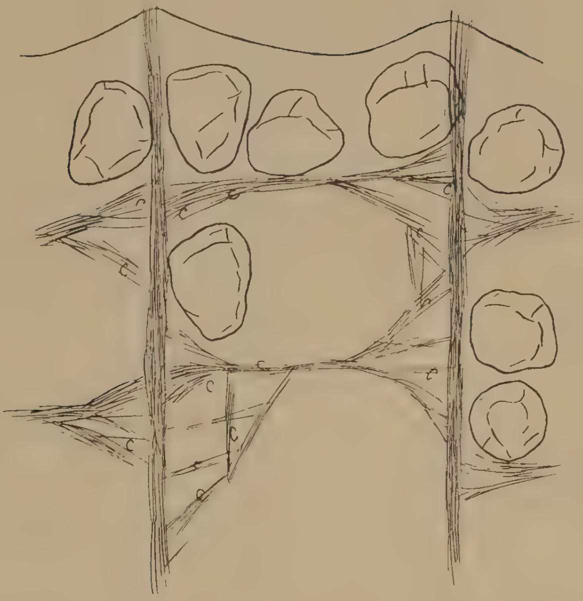
REMARKS.—The original description of *Spongia fragilis* clearly shows what Montagu (1818, p. 114) intended the name should represent, and this is supplemented by a more detailed description, together with figures, by Johnston (1842, p. 187, pl. xiii, fig. 6; pl. xiv, fig. 4). In the Bowerbank collection, preserved in the British Museum, is a specimen, B.M. 30.7.3.447, labelled "*Dysidea fragilis*, Type Specimen". The handwriting is unknown, but may be that of Johnston, and the specimen itself may have belonged to Montagu, and may actually be the one on which he based his original description. This is, however, pure surmise, for although there is reason to believe that some of the types of both Montagu and Johnston are in the Bowerbank collection, there is nothing on the labels to show this for a certainty. Under the circumstances, the matter can best be met by accepting this specimen as the neotype of *Spongia fragilis*, Montagu. The type being fixed, the next and more important step is to seek out the characters of the species and, more particularly, measure the variations to which these characters may be subject. That the species is a variable one in all respects has been taken for granted, but, unfortunately, so much has been taken for granted that although the species figures prominently in the literature, and has been recorded from many parts of the world, it is impossible from the available records to express in precise terms its characters. As a result, we have, on the one hand, a large number of diverse forms identified by various authors as *Dysidea* (*Spongelia*) *fragilis*, or as varieties thereof, which may or may not belong to the species ; and, on the other hand, we have numerous other species described which may conceivably be synonymous with it.

In addition to the specimen already discussed, there are in the Bowerbank collection nearly twenty other examples labelled "*Dysidea fragilis*, Montagu", collected from various parts of the British Isles. From their general resemblance to each other it may be safely assumed that these are all conspecific. In external form they vary to some extent, most of them being small and roundly massive or thinly encrusting with small oscules scattered irregularly over the surface. In some of these, incipient mammillate lobes may be seen, each bearing an oscule at the summit. By easy stages we pass from such forms to those consisting of a basal mass from which arise flabellate, mammillate or digitate upgrowths, which may fuse to give rise to irregular ridges or crests bearing oscules in linear series along the upper border of the crest. The oscules tend to be laterally placed on the digitate processes and apically in all other cases. The surface conuli are always present, but vary slightly in height and in the distance from each other. The distribution of the conuli is determined by the position of the main fibres of the skeleton, and varies as the distance between neighbouring main fibres varies. The type consists of a large massive specimen, 4 cm. high by 7 cm. long by 4 cm. across, with three large oscules on the upper surface, the largest 2 cm. in diameter, leading into deep cloacae.

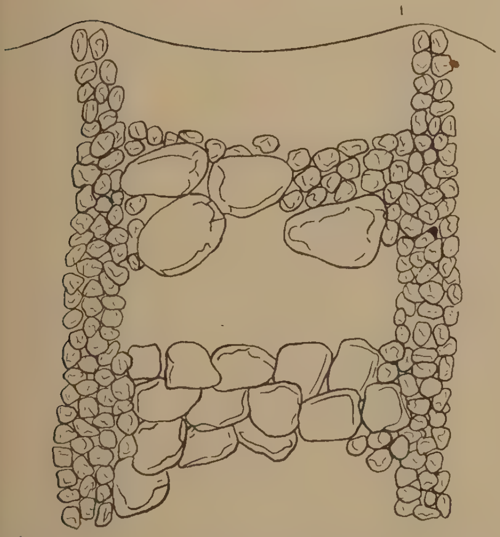
The variations in external form are considerable, but are only of such magnitude as might be expected in such a species, but the variation in the structure of the skeleton is more striking. In the type (Text-fig. 19) it consists of fibres formed of foreign spicules, with large grains of sand scattered between. The reticulation so formed contains primary or ascending fibres and more slender and irregular secondary or transverse fibres. The spicules are mainly oxea with some styli, but include also numerous microscleres, sigmata, toxa and anisochelae. At first sight the specimen appears to be an example of *Gellius angulatus* (Bowerbank) containing sand-grains and foreign spicules, but other considerations suggest that it is a *Dysidea*, in which the spicules of *Gellius angulatus* form the major part of the foreign inclusions. Very little spongin is visible. A second specimen from the Bowerbank collection, B.M. 30.7.3.440, has for skeleton a reticulation of fibres filled with sand-grains, with no visible spongin. The secondary fibres are as regular as the primaries and thicker, the latter being due to the larger size of the enclosed sand-grains (Text-fig. 20). In B.M. 30.7.3.442, a third specimen, the fibres are again filled with sand-grains, but these are all small, and the secondary fibres, instead of being regular transverse fibres, form an irregular secondary network. Spongin is abundantly visible (Text-fig. 21). A fourth specimen, B.M. 30.7.3.441, has primary fibres filled with large sand-grains, the secondary fibres, which again form an irregular network, are for the most part without inclusions, but may contain fine sand-grains or a few fragments of spicules (Text-fig. 22). A fifth specimen, B.M. 30.7.3.446, has a similar skeleton to that of the fourth specimen, but spongin is less conspicuous in the primary fibres (Text-fig. 23). The remaining specimens have skeletons of characters similar to those of the foregoing



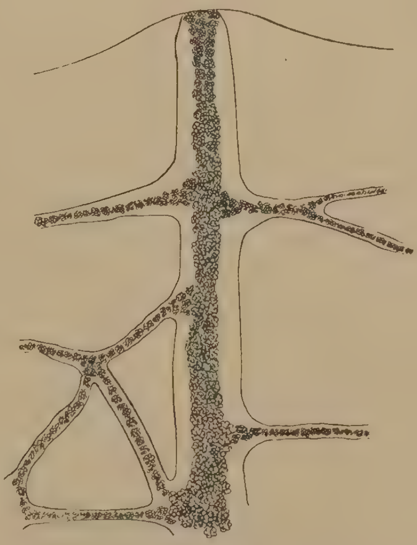
TEXT-FIG. 18.—*Dysidea fragilis* (Montagu), showing structure of fibre.



TEXT-FIG. 19.—Neotype of *Spongelia fragilis* (Montagu), B.M. 30.7.3.447. From a section at right angles to surface. × 50.

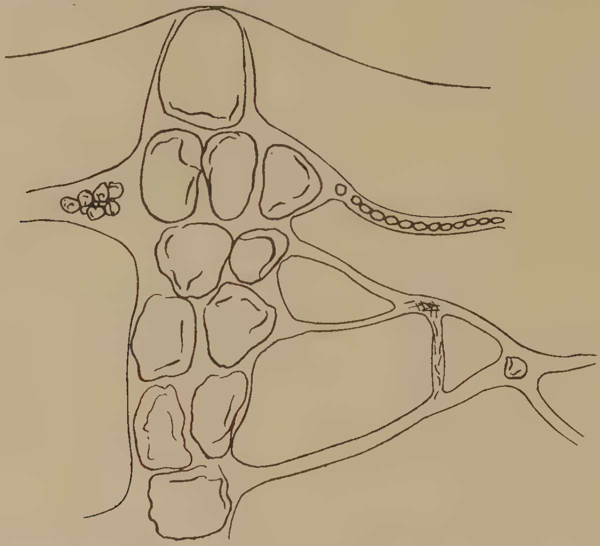


TEXT-FIG. 20.—*Dysidea fragilis* (Montagu), from the Bowerbank collection (B.M. 30.7.3.440). From a section at right angles to surface. × 50.

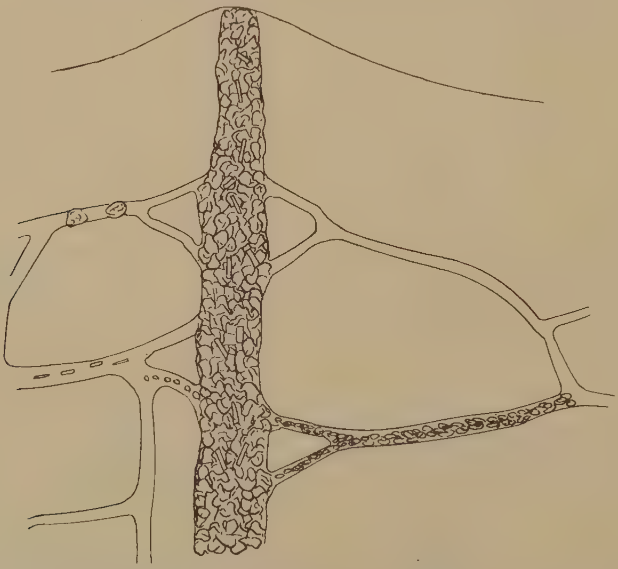


TEXT-FIG. 21.—*Dysidea fragilis* (Montagu), from the Bowerbank collection (B.M. 30.7.3.442). From a section at right angles to surface. × 50.

five specimens, or are of an intermediate nature. In each case the type of skeleton figured here is only the predominant form, and transitions from this to most of the others may be found in a single individual by careful searching.

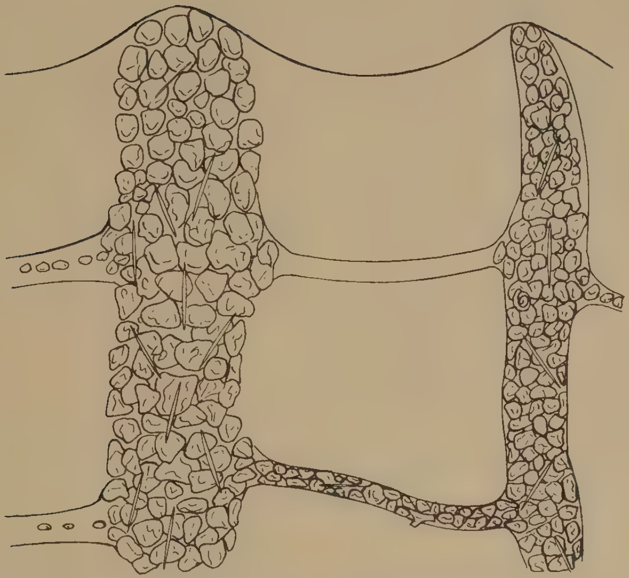


TEXT-FIG. 22.—*Dysidea fragilis* (Montagu), from the Bowerbank collection (B.M. 30.7.3.441). From a section at right angles to surface. × 50.

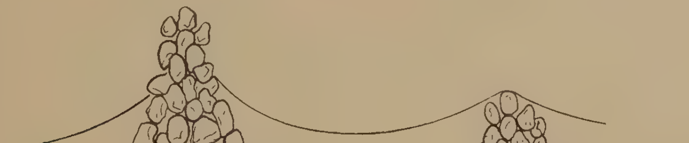


TEXT-FIG. 23.—*Dysidea fragilis* (Montagu), from the Bowerbank collection (B.M. 30.7.3.446). From a section at right angles to surface. × 50.

In case there may be a possibility that certain types of skeleton may be correlated with a particular external form, further researches were made with other specimens showing a greater similarity externally than those in the Bowerbank collection. These show conclusively how variable is the skeleton in this species, not only in the structure



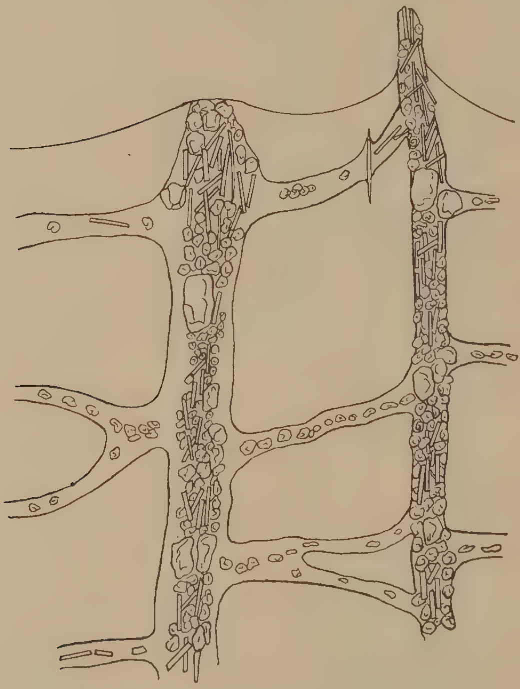
Text-fig. 24.—*Dysidea fragilis* (Montagu), from the Dorset coast (B.M. 97.8.9.70–71). From a section at right angles to surface. × 50.



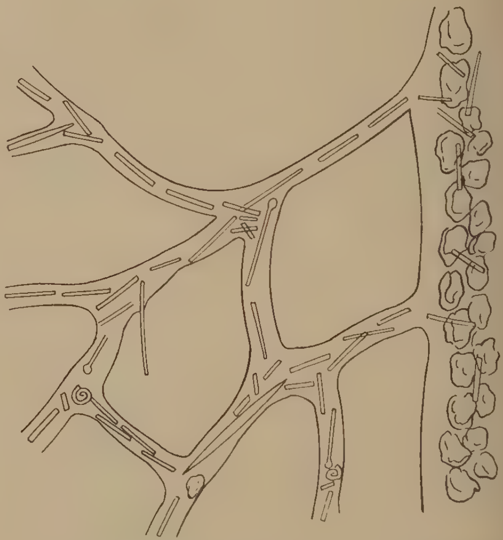
Text-fig. 25.—*Dysidea fragilis* (Montagu), from Poole, Dorset (B.M. 89.7.26.7–12). From a section at right angles to surface, × 50.

of the main reticulation, but in the nature of the inclusions; and also that the type of skeleton bears no relation to the external form.

The material chosen consists of a group of specimens in the British Museum collection identified by various workers as *Spongelia fragilis* (Montagu). The first of these, B.M. 97.8.9.70–71, collected by Kirkpatrick on the Dorsetshire coast, is a small subspherical specimen about 1 cm. high (Plate II, fig. 9), with conulose surface and two small oscules on the upper surface. The skeleton consists of a coarse reticulation of primary fibres of spongin filled with moderately large sand-grains and occasional foreign spicules. The primary fibres are connected at intervals by more slender secondary fibres, which may be completely filled with sand-grains, or may contain only a central core thereof, or may be entirely free from foreign inclusions (Text-fig. 24). The second specimen, B.M. 89.7.26.7–12, from Poole, is slightly larger than the first (Plate II, fig. 10), but resembles it closely in external appearance. In this, the skeleton is a coarse reticulation of fibres entirely filled with moderately large sand-grains. The secondary fibres are stout, and always completely filled with sand. Spongin is nowhere apparent in this sponge, although its presence may be assumed in view of the compact and regular structure of the fibres (Text-fig. 25). A third specimen, B.M. 25.11.1.1034, from the English Channel (?), closely resembling the first two specimens (Plate II, fig. 5), is slightly larger still, with oscules in linear series along the upper surface. In this the skeleton is again a reticulation of primary and secondary fibres, but both are much more slender, and the secondary

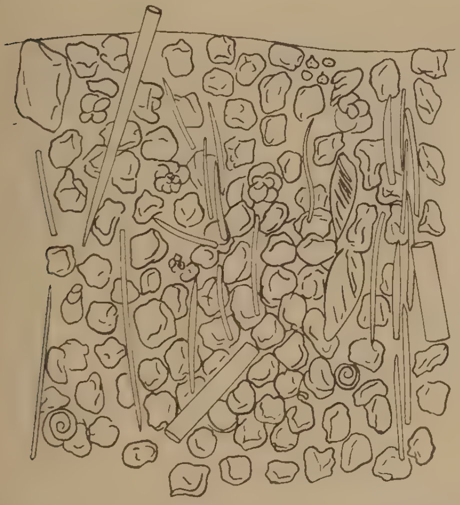


Text-fig. 26.—*Dysidea fragilis* (Montagu), from the English Channel (B.M. 25.11.1.1034). From a section at right angles to surface. × 50.

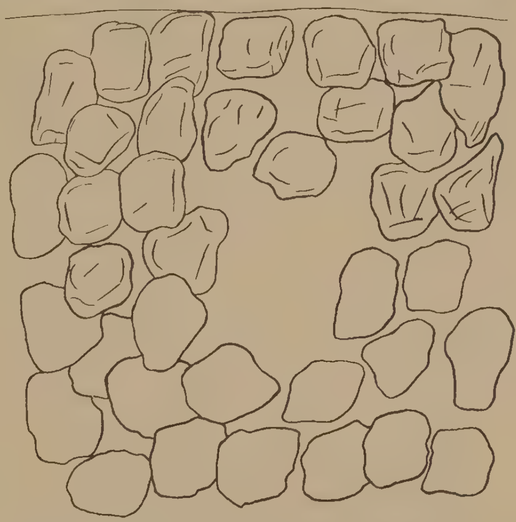


Text-fig. 27.—*Dysidea fragilis* (Montagu), from Littlehampton. From a section at right angles to surface. × 50.

fibres are irregular and often branched. The inclusions are mainly foreign spicules and small grains of sand, with a few foraminifera and large sand-grains. In the primary fibres the inclusions do not occupy the whole of the fibre, and a considerable quantity of spongin is visible surrounding them. In the secondary fibres, too, much spongin is visible (Text-fig. 26). In a fourth specimen, from the Sussex coast, the external form is very like that of the three already discussed, and the skeleton agrees on the whole with that of B.M. 97.8.9.70–71. An interesting modification occurs, however, in that the secondary fibres (Text-fig. 27), instead of remaining simple or only slightly branched, form an irregular network reminiscent of *Spongelia avara* (see Schulze, 1879, pl. vi, fig. 5). The general resemblance between these four specimens is such that no one would hesitate to regard them as representatives of a single species, yet the differences in the skeleton are considerable. The only conclusion to be drawn is, therefore, that the skeleton in this species consists typically of a reticulation of spongin fibres, with stout primary and slender secondary fibres, which may be filled, or even replaced, to a varying degree by foreign inclusions; and that these inclusions may be of differing nature, such as sand-grains, sponge-spicules or foraminifera. Further, that the secondary fibres may be simple transverse connectives, or may branch and anastomose to form an irregular reticulation.

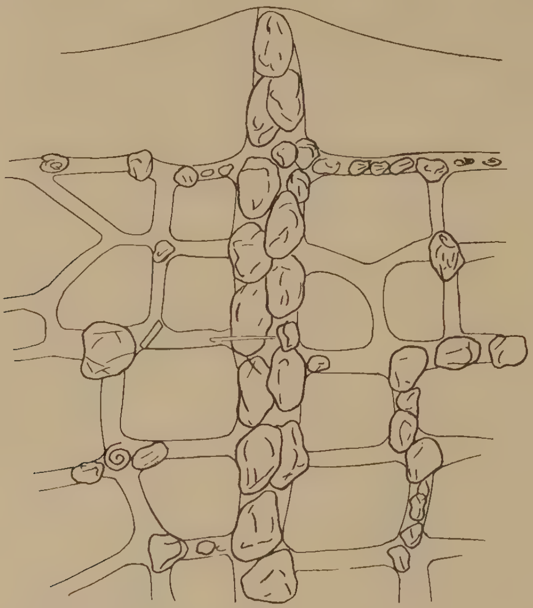


TEXT-FIG. 28.—*Dysidea fragilis* (Montagu), from Norway (B.M. 10.1.1.598). From a section at right angles to surface. × 50.

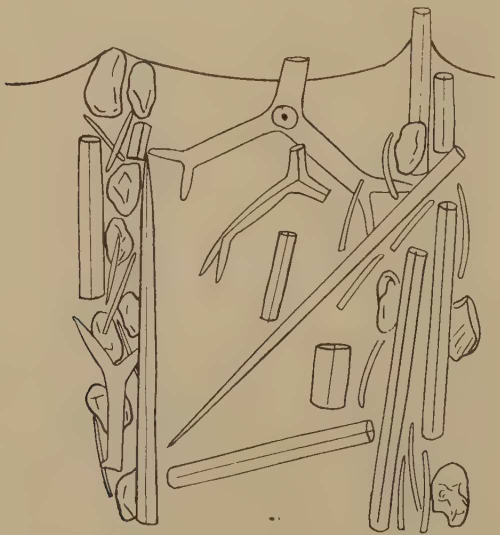


TEXT-FIG. 29.—*Dysidea fragilis* (Montagu), from Hastings (B.M. 81.5.5.31–3). From a section at right angles to surface. × 50.

Comparing this group of four specimens with others already described, we see that the variations found in them only foreshadow what takes place in others. The specimen of *S. fragilis* recorded by me (1930, p. 496) from Norway, B.M. 10.1.1.598, has the same external form as B.M. 89.7.26.7–12, but has a somewhat coarser texture (Plate II, fig. 11), and the skeleton consists of a dense mass of sand-grains, sponge-spicules and foraminifera completely filling the choanosome. There is no visible sign of spongin, and the only hint of the suppressed reticulation typical of this species is found in the arrangement of some of the foreign spicules in ascending bands vertical to the surface (Text-fig. 28). A second specimen from Hastings, B.M. 81.5.5.31–33, collected and identified by Ridley, has a similar skeleton composed entirely of large sand-grains (Text-fig. 29). The specimen itself is depressed and spreading (Plate II, fig. 6). The surface conules are coarse and obtusely ended and the texture of the sponge harsh, as would naturally result from the tissues of the sponge being filled with coarse sand. The depressed form of the sponge is not unusual, since in the same jars as B.M. 97.8.9.70–71 and 89.7.26.7–12, and obviously conspecific with them, occur thinly encrusting and depressed



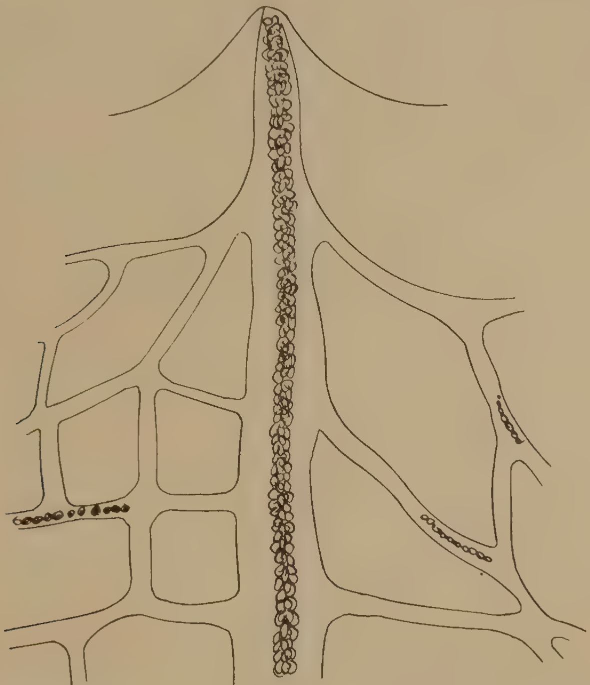
Text-fig. 30.—*Spongelia pallescens*, Schmidt (B.M. 67.7.26.9). From a section at right angles to surface. × 50.



Text-fig. 31.—*Spongelia pallescens*, Schmidt, from S.W. of Ireland (B.M. 82.7.28.12–15). From a section at right angles to surface. × 50.

forms. In some cases these depressed forms bear low mammillate processes, each with an oscule at the summit. The significance of this will be seen later.

A specimen, B.M. 67.7.26.9, from the Adriatic, purchased of O. Schmidt and labelled, in his handwriting, *Spongelia pallescens*, has a similar external form to those specimens from the English coast described above (Plate II, fig. 4). This appears to be the type-specimen figured by Schmidt (1862, pl. iii, fig. 8), and is accepted here as the holotype of *S. pallescens*. In this the skeleton consists of stout primary fibres filled with sand-grains, and an irregular reticulation of secondary fibres sprinkled with sand-grains (Text-fig. 30).



Text-fig. 32.—*Spongelia pallescens*, var. *elastica*, Schulze (B.M. 83.12.4.26). From a section at right angles to surface. × 50.

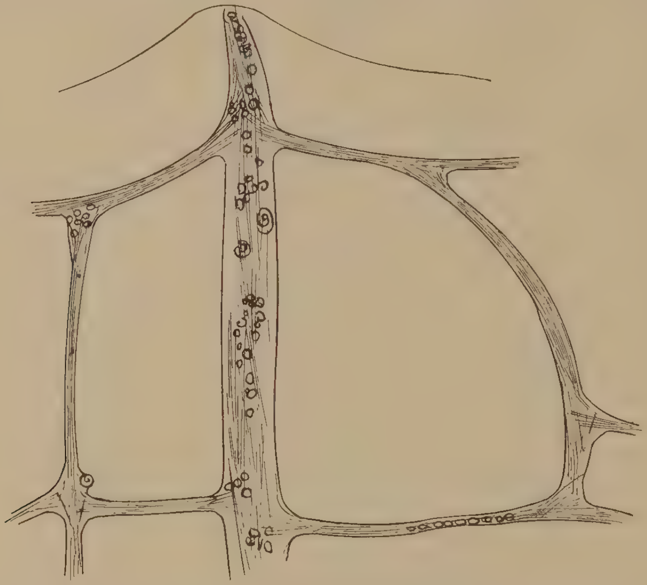
Carter's specimen (1876, p. 232) of *S. pallescens* from S.W. Ireland, B.M. 82.7.28.12–15, is a small, massive specimen with the usual surface conulation, with oscules on the upper surface and a coarse texture. The skeleton is composed of the spicules of *Stryphnus ponderosus* (Bowerbank), and a few sand-grains arranged in an incipient reticulation, but with no visible spongin (Text-fig. 31).

All the specimens enumerated above may be regarded as conspecific, and, now that some measure of the variation of the skeleton has been found, it is possible to consider which of the forms hitherto described belong also to *Dysidea fragilis* (Montagu).

Dysidea coriacea, Bowerbank, represented in the Bowerbank collection by two specimens, has the encrusting form and external appearance commonly found in *D. fragilis*, and is apparently conspecific with that species. In the first of the two specimens the skeleton is intermediate between those of B.M. 10.1.1.598 and B.M. 97.8.9.70–71. The skeleton of the second consists of primary fibres with very little foreign matter included, and an irregular secondary network of fibres free from inclusions, very much as in *Spongelia pallescens*, var. *elastica* (Text-fig. 32).

According to Schulze (1879, p. 125), *Spongia tupha*, Pallas (1766, p. 398), is a *Spongelia* (= *Dysidea*), and Schmidt (1862, p. 58) has suggested the possibility of its identity with his *Spongelia elegans*, Nardo. Pallas's description of *Spongia tupha* is not sufficient for the recognition of the species, and such speculations as those of Schulze and Schmidt are meaningless. On the other hand, the *Spongia tupha* of Martens (1824, p. 534) and Lieberkühn (1859, p. 358) is almost certainly the same thing as *Dysidea fragilis* (Montagu).

Spongelia elegans, Nardo, the type of the genus *Spongelia*, is unrecognizable from the original description, but Schmidt (1862, p. 28, pl. iii, fig. 5) has assigned certain specimens to it which appear to be digitate forms of *Dysidea fragilis*. The specimens of both Nardo and Schmidt are not available for examination, but as the latter probably saw Nardo's types, and as his figure can be recognized with some degree of accuracy, *Spongelia elegans*, Nardo, is here accepted as a synonym of *Dysidea fragilis*. In the same work Schmidt describes three new species of *Spongelia*, *S. avara*, *S. incrustans* and *S. pallescens*. The last of these has been shown above to be a synonym of *Dysidea fragilis*, and *Spongelia incrustans* from Schmidt's figure is almost certainly the same. *S. avara* seems to differ from *Dysidea fragilis* in that the surface conules are from 2 mm. to 5 mm. apart, but whether this can be regarded as sufficient reason for specific distinction is doubtful, though it is true that the specimen identified by Schulze (1879) as *Spongelia avara*, Schmidt, may conceivably be specifically distinct from Montagu's species. The difference between the holotype of *S. avara* and Schulze's specimens is due entirely to a greater distance between the conules in the latter, though this is hardly a matter for specific distinction.



Text-fig. 33.—*Spongelia pallescens*, var. *fragilis*, Schulze (B.M. 83.12.14.18). From a section at right angles to surface. × 50.

It would be impracticable here to consider in detail every specimen, but the list of synonyms given above has been compiled by comparison of type and authentic specimens, or with written descriptions where no specimens were available, with a large series of

Dysidea fragilis from European waters, and there is little reason to doubt that all the forms therein mentioned are conspecific.

DISTRIBUTION.—Almost cosmopolitan.

Dysidea reticulata (Thiele).

Dysideopsis reticulata, Thiele, 1899, p. 28, pl. iii, fig. 7; *Spongelia elegans*, Shaw, 1927, p. 438.

OCCURRENCE.—Stn. XXV, 17th March, 1929: in Papuan Pass, 20–25 fath., foraminifera and coral fragments.

REMARKS.—The specimen is fragmentary, and consists of irregular cylindrical branches with finely conulose surface. The surface conuli are only barely perceptible, but their positions are marked by small, light-coloured patches, the ends of the sand-filled primary fibres showing through the dermis. The skeleton is an irregular network of sand-filled fibres, in which primary fibres can with difficulty be recognized. The sand-grains are mainly of small size and the primary fibres measure ·09 mm. in diameter, the secondary fibres being about ·048 mm. in diameter.

The Barrier Reef specimen does not agree in all respects with the holotype of the species, particularly in the matter of the appearance of the surface. In the holotype the surface conuli are more pronounced, and the sponge itself consists of a basal mass from which short digitate processes arise. The specimens described by Shaw (*loc. cit.*) as *Spongelia elegans*, Nardo, are, however, intermediate to some degree betwen the holotype and the present specimen. They consist mainly of bunches of erect digitate processes, and in some the basal mass is conspicuous, but in others the processes arise directly from the substratum. They show also that the development of the surface conuli is subject to some variation, and comparing them with the holotype and the Barrier Reef specimen, it seems probable that all are representatives of a single species.

DISTRIBUTION.—Celebes; Tasmania.

Dysidea herbacea (Keller).

Spongelia herbacea, Keller, 1889, p. 336, pl. xx, fig. 1; *Dysideopsis palmata*, Topsent, 1897, p. 482, pl. xx, fig. 25; *Spongelia delicatula*, Row, 1911, p. 364; *S. digitata*, Sollas, 1902, p. 220, pl. xiv, fig. 4; pl. xv, fig. 2; *Dysideopsis topsenti*, Hentschel, 1912, p. 439; *Spongelia elegans*, var., Dendy, 1916, p. 140; *nec Spongelia elegans*, Nardo et Auctt.

OCCURRENCE.—Between Anchorage Reefs and Mangrove Park, Mangrove Park, Low Isles and Batt Reef. Stn. XXIII, 12th March, 1929: in lee of Turtle Is., 8 fath., mud and shell.

DISTRIBUTION.—Red Sea; Indian Ocean; Malay Area; Australia (south coast).

Family APLYSINIDAE.

Genus *Luffariella*, Thiele.

Luffariella variabilis (Poléjaeff).

Luffaria variabilis, Poléjaeff, 1884, p. 69, pl. ix, figs. 1–6; *Luffariella variabilis*, Thiele, 1899, p. 25.

OCCURRENCE.—Stn. XXI, 11th March, 1929: ½ mile N.W. of Howick Is., 10 fath., mud, shells and foraminifera. Stn. XXIV, 13th March, 1929: ¾ mile N.E. of Pasco Reef, 16½ fath., hard, shelly.

Remarks.—The two specimens have the massive form of the second of Poléjaeff's specimens, but the surface characters of his ramose form. In other features they agree closely with both.

Distribution.—New Hebrides and Tahiti.

Genus *Aplysina*, Nardo.

Aplysina mollis, Row, var. *aruensis*, Hentschel.

A. mollis, var. *aruensis*, Hentschel, 1912, p. 436.

Occurrence.—Stn. X, 22nd February, 1929: Satellite Reef, 14–17 fath., coral, shell, gravel and mud.

Remarks.—The two sponges consist of irregular basal masses from which digitate processes, several centimetres high and up to ·5 cm. diameter, arise. They appear to agree with Hentschel's (*loc. cit.*) description of var. *aruensis*, but to differ markedly from Row's specimen. If the identification of the present specimens proves correct, it will probably be necessary to regard the var. *aruensis* as a distinct species.

Distribution.—Aru Island.

Genus *Druinella*, Lendenfeld.

Druinella purpurea (Carter).

Aplysina purpurea, Carter, 1880, p. 36; Dendy, 1889, p. 971; *A. purpurea*, Carter, 1881, p. 366; *nec* Dendy, 1905, p. 224, and Row, 1911, p. 377; *nec Psammopemma purpureum* (Carter), Kirkpatrick, 1900, p. 358.

Occurrence.—Low Isles, the Thalamita Flat, Mangrove Park and North-east Moat.

Remarks.—The original description gives little information concerning the characters of the species, except that it is "cactiform on the surface", irregular, and black-purple in colour. Later, Carter (1881) described other specimens from Ceylon and Australia, under the same name, and one of these he figured. According to these figures the sponge from Ceylon is cactiform and black-purple in colour, with a skeleton in which the main fibres are fasciculated (*cf.* Carter, 1881, pl. ix, fig. 1*h*). On the other hand, Dendy's specimen from the Gulf of Manaar has a different type of skeleton and belongs to the genus *Druinella*, Lendenfeld. In either case, it is more probable that Dendy's sponge, from the type-locality, should be conspecific with the holotype than Carter's second specimen, from Ceylon. Therefore, if it should prove that the holotype is definitely lost, as seems probable, I would suggest that Dendy's specimen from the Gulf of Manaar be taken as neotype; and provisionally, I accept this sponge as the type of the species.

The four specimens of the present collection all agree with the type, as here understood, so that the species certainly extends from India to the Great Barrier Reef; and it is of interest to record another typical example from Cape Boileau, N.W. Australia (B.M. 30.12.1.13).

Too much stress laid on the purple colour, and too little on the more essential details of anatomy, has led to errors by various authors. For example, Carter's specimens of

Aplysina purpurea from Ceylon and Australia belong to the genus *Psammaplysilla*, Keller, and may even be conspecific with the genotype, *P. arabica*. Lendenfeld (1889, p. 636) has suggested the identity of *Holopsamma fuliginosum*, Carter, and *Pseudoceratina durissima*, Carter, with *Aplysina purpurea*, Carter (1881, *nec* 1880), but all three are generically distinct, and none is congeneric with *A. purpurea*, Carter, *sensu stricto*.

Psammopemma purpureum (Carter), Kirkpatrick (1900, p. 358), is probably synonymous with *Halisarca rubitingens*, Carter.

DISTRIBUTION.—India ; N.W. Australia ; Great Barrier Reef.

Druinella ramosa, Thiele.

D. ramosa, Thiele, 1899, p. 24, pl. iii, fig. 3 ; pl. iv, fig. 5.

OCCURRENCE.—Outer Barrier, Ribbon Bay, middle zones, 4th June, 1929 ; Outer Barrier, Yonge Bay, Reef Crest, 5th June, 1929.

DISTRIBUTION.—Celebes.

Family APLYSILLIDAE.

Genus *Aplysilla*, Schulze.

Aplysilla rosea (Barrois).

(For synonymy see Burton, 1930, p. 510.)

OCCURRENCE.—Stn. XII, 24th February, 1929 : Penguin Channel, 10–15½ fath., rock and shell gravel, mud on edges of pit.

DISTRIBUTION.—Mediterranean ; Atlantic coasts of Europe ; Australia (east coast).

Genus *Dendrilla*, Lendenfeld.

Dendrilla membranosa (Pallas).

Spongia membranosa, Pallas, 1766, p. 398 ; *S. membranacea*, Esper, 1794, p. 256, pl. xxxiv ; *Spongelia cactus*, Selenka, 1867, p. 565 ; *Aplysilla cactus*, Schulze, 1878, p. 417 ; *Dendrilla rosea*, Lendenfeld, 1883, p. 271, pl. x, figs. 3, 4 ; pl. xii, figs. 16, 19–23 ; pl. xiii, figs. 24–27, 29–31 ; *Aplysina membranosa*, Ridley, 1884, p. 391 ; *A. pallasi*, *idem*, *l. c.*, p. 600 ; *Luffaria rosea*, Carter, 1885, p. 201 ; *Aplysina caespitosa*, *idem*, *l. c.*, p. 282 ; *A. massa*, *idem*, *l. c.*, p. 284 ; *A. noevus*, *idem*, *l. c.*, p. 285 ; ? *A. cruor*, *idem*, *l. c.*, p. 286 ; *Dendrilla membranosa*, Lendenfeld, 1889, p. 715 ; *D. rosea* var. *typica*, *idem*, *l. c.*, p. 718, pl. xliv, figs. 4, 7, 11 ; pl. xlv, figs. 3, 4, 7, 9, 11 ; *D. rosea* var. *digitata*, *idem*, *l. c.*, p. 718, pl. xliv, fig. 8 ; pl. xlv, fig. 8 ; *D. ianthelliformis*, *idem*, *l. c.*, p. 719 ; *D. cavernosa*, *idem*, *l. c.*, p. 719, pl. xliv, figs. 3, 5, 12 ; pl. xlv, figs. 2, 5 ; *Spongelia chilensis*, Thiele, 1905, p. 485, fig. 20 ; *Dendrilla antarctica*, Topsent, 1908, p. 11, pl. iii, fig. 2 ; pl. iv ; *Aplysina praetensa*, Row, 1911, p. 374, pl. xxxvi, fig. 11 ; *Cacospongia cavernosa*, *idem*, *l. c.*, p. 377 ; *Dendrilla rosea*, var. *typica*, Hentschel, 1912, p. 930 ; *D. mertoni*, *idem*, *l. c.*, p. 433 ; *Dendrilla antarctica*, Hentschel, 1914, p. 137 ; *Megalopastas retiaria*, Dendy, 1916, p. 137, pl. iv, fig. 27 ; *Dendrilla antarctica*, Topsent, 1917, p. 31 ; *D. cavernosa*, Shaw, 1927, p. 437 ; *D. membranosa*, Burton, 1929, p. 448.

OCCURRENCE.—Stn. XII, 24th February, 1929 : Penguin Channel, 10–15½ fath., rock and shell gravel. Stn. IX, 22nd February, 1929 : Penguin Channel, 12–14 fath.

REMARKS.—The above list of synonyms is probably far from complete. It includes only the names of species and varieties whose representative specimens, in most cases type-specimens, have been examined, or such species as are obviously shown by their original descriptions to be synonyms of *D. membranosa* (Pallas). Doubtless a number of other described species will prove eventually to be synonymous with this species.

The various specimens here regarded as belonging to this species differ in slight details of form, colour, thickness of fibre and in the size of the meshes forming the skeleton, all of which are commonplace variations. The external form ranges from encrusting to irregularly massive, flabellate or digitate.

Distribution.—Red Sea; Indian Ocean; Malay Area; Australia (north coast); Antarctic; S. America.

Genus *Basta*, Oken.

Basta, Oken, 1815, p. 77; *Ianthella*, Gray, 1869, p. 49.

Remarks.—The name *Ianthella* has been universally accepted for *Spongia flabelliformis*, Pallas, and its allies, but, unfortunate though it be, it is not possible to ignore the earlier name given by Oken. This author included two species in the genus *Basta*, *B. ventilabrum* and *B. flabelliformis*, and added "Hierher *Spongia basta*." Whatever else he may have meant, and his references to the genus and its species are not very lucid, it is clear that Oken regarded *Spongia basta*, Pallas, as the representative of his genus *Basta*, with *B. flabelliformis*, Pallas, as a second species. It is not clear what the *B. ventilabrum* mentioned by Oken was intended to represent.

Basta flabelliformis (Pallas).

Spongia flabelliformis, Pallas, 1766, p. 380; *Ianthella flabelliformis*, Gray, 1869, p. 49; *Verongia flabelliformis*, Ehlers, 1870, p. 11; *Ianthella flabelliformis*, Lendenfeld, 1889, p. 696, pl. xlvii, figs. 1–4, 6; pl. xlviii, figs. 1–4; pl. xlix, figs. 1–3; Whitelegge, 1902, p. 62 (sep. copy); Hentschel, 1912, p. 434; Wilson, 1925, p. 474. (For further synonymy see Lendenfeld, 1889.)

Occurrence.—Stn. XII, 24th February, 1929: Penguin Channel, 10–15½ fath., rock and shell gravel.

Distribution.—Indian Ocean; Malay Area; Philippines; Australia (north, east and west coasts).

SPONGES OF THE SAVILE KENT COLLECTION FROM THE GREAT BARRIER REEF; WITH A NOTE ON *CALLYSPONGIA RAMOSA* (GRAY).

I. The Savile Kent Collection.

The following species are represented in the British Museum collection by specimens collected by Savile Kent; but as these specimens bear only the label "Great Barrier Reef: Savile Kent Coll.", and no more exact information is available as to the locality, it has been thought better to include them in an appendix.

Unlike the species of which material was obtained by the Great Barrier Reef Expedition, the species represented by the Savile Kent collection are exclusively Australian.

Haliclona brassicata (Carter).

Phakellia brassicata, Carter, 1885, p. 363; *Reniera vasiformis*, *idem*, 1886, p. 445; *R. brassicata*, Dendy, 1895, p. 236.

Occurrence.—Great Barrier Reef; Savile Kent coll.
Distribution.—Australia (east and south coasts).

Callyspongia ramosa (Gray).

Spongia ramosa, Gray, 1843, p. 295; *Pachychalina ramosa*, Dendy, 1898, p. 318, pl. xxxiii. (See also p. 603.)

Occurrence.—Great Barrier Reef; Savile Kent coll.
Distribution.—New Zealand; Australia (east and south coasts).

Genus *Euplacella*, Lendenfeld.

Euplacella, Lendenfeld, 1887, p. 798; *Placochalina*, *idem*, *l. c.*, p. 790.

Genolectotype.—*E. australis*, Lendenfeld, 1887, p. 789.

Diagnosis.—Chalininae with main skeleton a coarse reticulation of stout, horny fibres cored by oxea; special dermal skeleton of more slender fibres forming a reticulation of polygonal mesh, subdivided by secondary fibres, echinated at nodes by brushes of spicules set at right angles to surface.

Remarks.—The original diagnosis of *Euplacella* reads: "Dünnplatige Plocochalininae mit glatter Oberfläche und zahlreichen regelmässig vertheilten Osculis, welche ausschliesslich auf einer Seite vorkommen. Skeletnetz eng, hexactinellid, mit dicker Fasern. Mit kleinen, schlanken wenig zahlreichen Nadeln." In this the statements concerning the skeleton and the spicules contain nothing diagnostic, as they are applicable equally to all Chalininae of the "Pachychalina" type. The genus is founded, therefore, entirely on the external form. The genus *Placochalina* is similarly founded on external form, viz.: "Grosse, derbe, gestielte, plattige, Placochalininae mit hochwelliger Oberfläche, dicken Skeletfasern und undeutlichen oder mit einem Netz übersponnenen Osculis". On comparing Lendenfeld's descriptions and figures of the various species assigned to these genera, it is apparent that the species are not only congeneric, but the majority are conspecific. On the other hand, the one essential feature characterizing them all, and distinguishing them sharply from other genera of the "Pachychalina" group, namely, the peculiar structure of the dermal skeleton, is entirely overlooked.

External form cannot be used alone as a means of generic distinction in a group in which this feature is so variable. The characteristic structure of the dermal skeleton must therefore be the chief means of diagnosis. And on this basis, a number of other species must be included in the genus *Euplacella* as here understood. These include *Siphonochalina annulata*, Ridley and Dendy, *Pachychalina elongata*, Ridley and Dendy, *Chalinissa communis*, Lendenfeld (see p. 598), *Phylosiphonia stalagmitis*, Lendenfeld, and *P. elegans*, Lendenfeld.

Euplacella australis, Lendenfeld.

E. australis, Lendenfeld, 1887, p. 789; *E. frondosa, idem, l. c.*, p. 789, pl. xxi, fig. 36; *Pachychalina australis*, Whitelegge, 1906, p. 457.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Remarks.—The single specimen is typical in all respects.

Distribution.—Australia (north, east, west and south coasts).

Euplacella annulata (Ridley and Dendy).

Siphonochalina annulata, Ridley and Dendy, 1886, p. 331; *eidem*, 1887, p. 31, pl. vii, fig. 2; *Phylosiphonia annulata*, Lendenfeld, 1887, p. 789, pl. xxiii, fig. 45; *Siphonochalina annulata*, Whitelegge, 1906, p. 459.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Remarks.—Two specimens were obtained: the first consists of a group of tubes, 9 cm. high, rising from a common base; and the second is stipitate, with a series of 7 tubes arranged fan-wise at the top of a stout stalk, the total height of the specimen being 17 cm. In both the skeleton is typical.

Distribution.—Australia (south and east coasts).

Euplacella communis (Lendenfeld).

Chalinissa communis, var. *flabellum*, Lendenfeld, 1887, p. 772, pl. xx, fig. 32; pl. xxvii, figs. 5, 11, 13, 15; *C. communis*, var. *digitata*, *idem, l. c.*, p. 772, pl. xx, fig. 30; *C. tenuifibris, idem, l. c.*, p. 773, pl. xx, fig. 29; *C. serpens, idem, l. c.*, p. 773, pl. xx, fig. 33; *C. elegans, idem, l. c.*, p. 773, pl. xx, fig. 27; *C. rigida, idem, l. c.*, p. 773; *C. elongata, idem, l. c.*, p. 774, pl. xx, fig. 34; *C. ramosa, idem, l. c.*, p. 774, pl. xx, fig. 31.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Remarks.—The representatives of the species included in the above list of synonyms are so obviously conspecific, when examined side by side, that it is unnecessary to say more about them.

Distribution.—Australia (east coast).

Euplacella mollissima, Lendenfeld.

Cavochalina bilamellata, Carter, 1885, p. 287; *Euplacella mollissima*, Lendenfeld, 1887, p. 790, pl. xxi, fig. 37; *Placochalina pedunculata*, var. *dura, idem, l. c.*, p. 791, pl. xxi, fig. 38; *P. pedunculata*, var. *poculum, idem, l. c.*, p. 792, pl. xxi, fig. 39; *P. pedunculata*, var. *mollis, idem, l. c.*, p. 792, pl. xxi, fig. 35. *Nec Spongia bilamellata*, Lamarck; *nec Cribrochalina poculum*, Schmidt.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Remarks.—It is doubtful whether this species is really distinct from *E. australis*, Lendenfeld.

There is a large series of specimens in the British Museum collection which shows clearly that the various species and varieties included in the synonymy list above are identical.

Distribution.—Australia (north, east and south coasts).

Tedaniopsamma, gen. n.

Genotype.—*Hircinia flabellopalmata*, Carter.

Diagnosis.—Myxillinae with main skeleton composed of a reticulation of horny fibres, filled with sand, with styli and raphides scattered in its interstices.

Remarks.—Lendenfeld (1889, p. 605) assigned *Hircinia flabellopalmata*, Carter, to the genus *Sigmatella*, remarking that the proper spicules were strongyla only. The spicules in the holotype of this species are styli and slender raphides, and the same is true of the three specimens from the Barrier Reef, which agree exactly with the holotype in external form also. The sponge figured by Lendenfeld (*loc. cit.*) appears to be the holotype, so that that author's statement regarding the spiculation may be taken to be the result of inaccurate observation.

Tedaniopsamma flabellopalmata (Carter).

Hircinia flabellopalmata, Carter, 1885, p. 313; *Sigmatella flabellipalmata*, Lendenfeld, 1889, p. 616, pl. xxxix, fig. 1; pl. xli, fig. 5.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Remarks.—Three specimens, the largest 60 cm. high by 30 cm. across.

Distribution.—Australia (south coast).

Clathria transiens, Hallmann.

C. transiens, Hallmann, 1912, p. 226, pl. xxxiii, figs. 1–3; pl. xxxiv, fig. 2; text-figs. 47, 48*a*.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Distribution.—Australia (south coast).

Wilsonella australiensis, Carter.

W. australiensis, Carter, 1885, p. 366; *Clathria australiensis*, Dendy, 1896, p. 33.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Distribution.—Australia (south coast).

Ophlitaspongia tenuis (Carter).

(For synonymy see Hallmann, 1912, p. 261.)

Occurrence.—Great Barrier Reef; Savile Kent coll.

Remarks.—The single specimen is thinly lamellar, very proliferous, anastomosing and low-growing. Thus it resembles in outward form both *Clathria angulifera*, Dendy, and *Wilsonella connectens*, Hallmann (1912, pl. xxxii, fig. 2), but the spiculation is typical.

Distribution.—Australia (south coast).

Ophlitaspongia axinelloides, Dendy.

O. axinelloides, Dendy, 1896, p. 39.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Distribution.—Australia (south coast).

Echinochalina glabra (Ridley and Dendy).

Echinoclathria glabra, Ridley and Dendy, 1886, p. 476; *idem*, 1887, p. 163, pl. xxix, fig. 11; pl. xxi, fig. 2; Dendy, 1896, p. 40; *Thalassodendron viminalis*, Whitelegge, 1901, p. 87; *Echinoclathria intermedia*, *idem*, 1902, p. 214; *Echinochalina reticulata, idem*, 1907, p. 506, pl. xlv, fig. 25; *E. glabra, idem, l. c.*, p. 507; *E. reticulata*, Hallmann, 1912, p. 289, pl. xxx, fig. 2, text-fig. 66; *E. reticulata*, var., *idem, l. c.*, p. 290, pl. xxxi, fig. 1; *E. glabra, idem, l. c.*, p. 290, text-fig. 67; *E. anomala, idem, l. c.*, p. 294, text-fig. 69.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Remarks.—The various specimens recorded under the names included in the above list of synonyms agree in general features, but differ in small details of spiculation. There is, however, nothing to justify a specific distinction, and such differences as are present amount to no more than the normal fluctuating variations.

Distribution.—Australia (south and east coasts).

Crella incrustans, var. *digitata*, Hallmann.

C. incrustans, var. *digitata*, Hallmann, 1912, p. 156, pl. xxiii, fig. 2, text-figs. 28, 29.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Remarks.—The specimen has the external form of *C. incrustans*, var. *digitata*, and the spiculation of the var. *perramosa*.

Distribution.—Tasmania.

Genus *Halichondria*, Fleming.

Halichondria, Fleming, 1828, p. 520; *Halispongia*, Blainville, 1830, p. 495; *Spuma*, Michlucho-Maclay, 1870, p. 13.

Remarks.—The first species mentioned by Blainville as belonging to *Halispongia* is *Spongia papillaris*, Grant (= *Halichondria panicea*, Auctt.). This is here taken as the genolectotype, so that *Halispongia* becomes a synonym of *Halichondria*.

Spuma borealis, as figured by Michlucho-Maclay, is obviously identical with *Halichondria panicea*.

Halichondria phakellioides, Dendy and Frederick. (Plate II, fig. 1.)

H. phakellioides, Dendy and Frederick, 1924, p. 498, pl. xxxvi, fig. 10.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Remarks.—A single specimen, composed of a number of vertical lamellae set at varying angles to each other, agrees closely with the holotype. A second specimen in the British Museum collection was obtained from Swan River, W. Australia.

Distribution.—Australia (west and south-west coasts).

Carterispongia elegans (Lendenfeld).

Phyllospongia elegans, Lendenfeld, 1889, p. 192, pl. v, fig. 4; pl. vii, fig. 2.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Remarks.—Three specimens were obtained, all of typical external form. In one of them the usual sandy inclusions of the fibres and cortex are replaced by foreign sponge spicules.

DISTRIBUTION.—Australia (west and east coasts).

Spongia officinalis, Linnaeus, var. *mollissima*, Schmidt.

Spongia mollissima, Schmidt, 1862, p. 23; *Spongia officinalis*, subsp. *mediterranea*, var. *mollissima*, Hyatt, 1877, p. 511, pl. xvi, fig. 21; *S. officinalis*, subsp. *mediterranea*, var. *zimocciformis*, *idem*, *l. c.*, p. 511; *Euspongia officinalis*, var. *mollissima*, Schulze, 1879, p. 616, pl. xxxv, figs. 1, 2; Lendenfeld, 1889, p. 268.

OCCURRENCE.—Great Barrier Reef; Savile Kent coll.

REMARKS.—Two large massive sponges, the larger 25 cm. by 16 cm. by 12 cm. high, appear to agree closely with this variety.

DISTRIBUTION.—Mediterranean.

Spongia lignea, Hyatt.

S. lignea, Hyatt, 1877, p. 515; *Euspongia officinalis*, var. *dura*, Lendenfeld, 1886, pp. 531, 533; *idem*, 1889, p. 275, pl. xii, fig. 2; pl. xxii, fig. 7.

OCCURRENCE.—Great Barrier Reef; Savile Kent coll.

REMARKS.—Hyatt's original description leaves much to be desired, but the reference to the hard, cork-like texture of the sponge makes it almost certain that the present identification is correct.

DISTRIBUTION.—Australia (east coast).

Spongia equina (Schmidt).

Euspongia equina, Schmidt, 1868, p. 4. (For further synonymy see Lendenfeld, 1889, pp. 302–8.)

OCCURRENCE.—Great Barrier Reef; Savile Kent coll.

REMARKS.—A large subspherical sponge, 28 cm. in greatest diameter, so abundantly infested with barnacles that its identification is rendered uncertain. From the small areas of the sponge unaffected by the commensals, it appears to be *Spongia equina* (Schmidt).

DISTRIBUTION.—Mediterranean; West Indies; Australia (all coasts).

Spongia zimocca, Schmidt.

S. zimocca, Schmidt, 1862, p. 23, pl. iv, figs. 3, 4; *Euspongia zimocca*, Schulze, 1879, p. 614, pl. xxxv, fig. 10; Lendenfeld, 1889, p. 261, pl. xxii, fig. 4; pl. xxxviii, fig. 6.

OCCURRENCE.—Great Barrier Reef; Savile Kent coll.

REMARKS.—A single specimen, dorso-ventrally flattened, measuring 22 cm. by 14 cm. by 3 cm., seems to be identical with this species.

The species has been previously identified from Australia by Lendenfeld (*loc. cit.*).

DISTRIBUTION.—Mediterranean; Australia (east coast).

Genus *Fasciospongia*, gen. n.

Genotype.—**Stelospongia australis*, var. *fovea*, Lendenfeld, 1889, p. 518.

Diagnosis.—Skeleton of stout, pithed fibres; primary fibres forming well-marked fasciated systems, each connected to neighbouring systems by a loose reticulation of secondary fibres; primary fibres cored by a weak line of broken sponge spicules; no special dermal skeleton.

Remarks.—In the structure of the fibres and the nature of the inclusions in the primary fibres, this species agrees with *Cacospongia* (see Topsent, 1929, pp. 9–10, text-figs. 2, 3). The distinction of the new genus depends on the fact that the primary systems run to the surface and are connected by an irregular system of secondary fibres.

The structure of the fasciated fibres is seen well in *Stelospongia costifera*, Lendenfeld, and *S. pulcherrima*, Lendenfeld, both of which must be regarded as belonging to *Fasciospongia*.

Fasciospongia fovea (Lendenfeld).

Stelospongia australis, var. *fovea*, Lendenfeld, 1889, p. 518, pl. xxiv, fig. 8; pl. xxv, fig. 4; pl. xxxi, figs. 7, 9; pl. xxxii, fig. 9.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Remarks.—This species is tolerably well figured by Lendenfeld. His pl. xxxi, fig. 7, shows the conspicuous nature of the fasciated primary fibres, but unfortunately Lendenfeld figures them as a series of straight lines instead of an intricate system of anastomosing and connected fibres. *Cacospongia amorpha*, Poléjaeff, is, contrary to Lendenfeld's assertion, not a synonym of the present species.

Distribution.—Australia (all coasts).

Genus *Euryspongia*, Row.

Genotype.—*E. lactea*, Row, 1911, p. 366, pl. xxxix, fig. 23; pl. xli, figs. 27, 28.

Diagnosis.—Skeleton composed of primary fibres, often cored with sand-grains, and connected by an irregular reticulation of secondary fibres; fibres laminated, non-pithed (?); no special dermal skeleton.

Euryspongia canalis (Lendenfeld).

Stelospongia canalis, Lendenfeld, 1889, p. 495, pl. xxiv, fig. 10; pl. xxix, figs. 2, 4, 5, 7; pl. xxxi, fig. 1; pl. xxxii, fig. 6.

Occurrence.—Great Barrier Reef; Savile Kent coll.

Remarks.—There is little to add to the original description, except that the main fibres often contain an axial filling of sand-grains, and that the description of the connecting fibres given by Lendenfeld is incorrect. He says, " The skeleton consists of simple main fibres, which are joined by simple or slightly branched connecting fibres." In actual fact the connecting fibres form a very irregular network between the main fibres, and it is this, coupled with the structure of the fibres, that determines the resemblance of this species to *Euryspongia lactea*, Row.

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* Genus *Stelospongos*, Schmidt.

Stelospongos, Schmidt, 1870, p. 29; *Stelospongia*, Schulze, 1879, p. 613; *Stelospongus*, Carter, 1885, p. 303.

Remarks.—The genus *Stelospongos* was founded by Schmidt but no species were named, and the diagnosis given is hopelessly inadequate. The name is therefore a *nomen nudum*. Unfortunately, under a revised spelling, it was made popular by Schulze and Lendenfeld, and has been used for a number of species of horny sponges, of which the only common feature is a fibre of stiff texture when dried.

A second specimen in the British Museum collection is labelled Swan River (West Australia).

Distribution.—Australia (south, east and west coasts).

II. Callyspongia ramosa (Gray).

Callyspongia ramosa (Gray).

Spongia ramosa, Gray, 1843, p. 295 ; *Pachychalina ramosa*, Dendy, 1898, p. 318, pl. xxxiii ; *Chalina polychotoma*, var. *trichotoma*, Carter, 1885, p. 115 ; *Cladochalina nuda*, Ridley, 1884, p. 395, pl. xli, fig. I; *C. nuda*, var. *abruptispicula*, *idem*, *l. c.*, p. 396, pl. xli, fig. J; *Toxochalina robusta*, Ridley and Dendy, 1887, p. 50 (*nec T. robusta*, Ridley) ; *Chalinopora paucispina*, Lendenfeld, 1887, p. 765 ; *Cladochalina dendroides*, *idem*, *l. c.*, p. 769, pl. xix, fig. 21 ; *C. mammillata*, *idem*, *l. c.*, p. 769 ; *C. tenuirhaphis*, *idem* *l. c.*, p. 769, pl. xix, fig. 24 ; *Pachychalina paucispina*, *idem*, *l. c.*, p. 776 ; *P. ramulosa*, et varr. *lamella* et *digitata*, *idem*, *l. c.*, p. 777, pl. xix, fig. 22 ; *P. macrospina*, *idem*, *l. c.*, p. 777 ; *P. elegans*, *idem*, *l. c.*, p. 777, pl. xix, fig. 18 ; *P. rigida*, *idem*, *l. c.*, p. 778, pl. xix, fig. 14 ; *P. oculata*, *idem*, *l. c.*, p. 778 ; *Ceraochalina papillata*, et varr. *macropora*, *intermedia* et *micropora*, *idem*, *l. c.*, pp. 780, 781, pl. xix, fig. 16 ; *C. nuda*, et varr. *oxyus* et *oxystrongylus*, *idem*, *l. c.*, pp. 781, 782 ; *C. levis*, *idem*, *l. c.*, p. 782, pl. xix, fig. 19 ; *C. microrhaphis*, *idem*, *l. c.*, p. 783 ; *C. multiformis*, et varr. *maeandra*, *elegans*, *lamella*, *digitata*, *mollis* et *dura*, *idem*, *l. c.*, pp. 783, 784, pl. xix, figs. 15, 20, 23, 25; pl. xxvii, figs. 4, 25; *C. tenella*, *idem*, *l. c.*, p. 785 ; *C. reteplax*, *idem*, *l. c.*, p. 785, pl. xix, fig. 17 ; *C. euplax*, *idem*, *l. c.*, p. 785, pl. xix, fig. 13 ; *C. extrema*, *idem*, *l. c.*, p. 785 ; *Dactylochalina mollis*, *idem*, *l. c.*, p. 812 ; *D. candelabrum*, *idem*, *l. c.*, p. 812 ; *D. conulata*, *idem*, *l. c.*, p. 813, pl. xviii, fig. 2 ; *D. australis*, *idem*, *l. c.*, p. 813 ; *Euchalinopsis dendroides*, *idem*, *l. c.*, p. 816, pl. xviii, fig. 8 ; *E. minima*, *idem*, *l. c.*, p. 816, pl. xviii, fig. 3 ; *Euchalina typica*, *idem*, *l. c.*, p. 817, pl. xviii, fig. 5; pl. xxvii, fig. 24; *E. paucispina*, *idem*, *l. c.*, p. 818 ; *E. macropora*, *idem*, *l. c.*, p. 818 ; *E. exigua*, et varr. *simplex* et *arborea*, *idem*, *l. c.*, p. 818, pl. xviii, figs. 6, 10 ; *E. phillippinensis*, *idem*, *l. c.*, p. 819 ; *Toxochalina difficilis*, Brøndsted, 1923, p. 132, fig. 14 ; *Chalina oculata*, var. *novae-zealandiae*, Dendy, 1924, p. 326 ; *Ceraochalina pergamentacea*, *idem*, *l. c.*, p. 327 ; *Pachychalina affinis*, Brøndsted, 1924, p. 455, fig. 13 ; *Toxochalina chalmeri*, *idem*, 1926, p. 5, fig. 4 ; *Cladochalina dendyi*, Burton, 1929, p. 421.

Diagnosis.—Sponge typically branching and erect, with oscules in linear series along margins of branches or scattered over faces of branches ; oscules level with surface, mammillate or incipiently fistulous (collar-like margins) ; branches rounded or flattened, with tendency to fuse, forming irregularly massive or flabellate individuals ; main skeleton a regular network with ascending fibres bi- or multispicular, conjunctive fibres usually unispicular ; dermal skeleton of small, primary meshes, subdivided into a few secondary meshes, usually unispicular, sometimes echinated ; spicules oxea, with abruptly pointed ends, ·03 to ·1 by ·002 to ·01 mm. ; toxa, often absent, ·03 to ·1 mm. chord.

Remarks.—*Spongia ramosa*, Gray, was re-described by Dendy (1898, *loc. cit.*) from four specimens from New Zealand. These were divided into two varieties, quite unnecessarily, as can now be seen. The sponges are erect, with long, cylindrical branches bearing numerous small oscules level with the surface, sometimes arranged in linear series along the sides of the branches, sometimes scattered generally over the surface of the sponge. The external form, therefore, resembles closely that of *Haliclona oculata* (Pallas).

The skeleton is differentiated into main and dermal portions, the latter being readily detachable from the outer ends of the ascending fibres of the main skeleton. The main skeleton consists of the usual quadratic mesh of spiculo-fibre, the ascending (primary) fibres being cored by a somewhat plumose series of spicules and the conjunctive (secondary) fibres by a linear series of single spicules. The dermal skeleton is unispicular throughout, and resembles, almost exactly, that of *Callyspongia fallax*, Duchassaing and Michelotti. The spicules are oxea, ·04 by ·005 mm., nearly straight, and abruptly pointed at each end. The lectotype of the species is specimen A (Dendy, *loc. cit.*, pl. xxxiii). The remaining three specimens differ so little in the main details of the skeleton, external form, texture, etc., that it is unnecessary to say anything more on this point, and it is most emphatically a waste of time to attempt to divide them into varieties. Two points may, however, be noted. In specimen B (B.M. 42.12.2.122) the dermal skeleton is echinated as in the type of *Patuloscula* (*cf.* p. 542, Text-fig. 6), and a few, very rare, toxa are present in the meshes of the dermal skeleton. This at first sight would appear to suggest a varietal, or even specific difference. In fact, if we were to attempt to maintain our old ideas of classification, the lectotype would be placed in the genus *Chalina*, or *Pachychalina* (according to the taste of the author), and specimen B in the genus *Toxochalina*. Further, specimen B is so like specimen C in all essential details that no one would hesitate to pronounce them identical, yet specimen C, although possessing very rare toxa, has a dermal skeleton which is not echinated. Moreover, while both specimen B and specimen C are in all other respects indistinguishable from it, the lectotype has a non-echinated dermal skeleton, and is without toxa. We have to be prepared, therefore, to regard the presence or absence of toxa, and the presence or absence of echinating spicules in the dermal skeleton, as features without taxonomic significance.

Dendy (*loc. cit.*, p. 318) included, as a synonym of *Chalina* (*Spongia*) *ramosa* (Gray), *Ceraochalina levis*, Lendenfeld. The specimens, three in number, described by Lendenfeld under this name are in the British Museum: The first (B.M. 86.10.27.436), from Port Chalmers, New Zealand, is a Sponge—Alga pseudomorph; the second (B.M. 86.8.27.443), the figured specimen (Lendenfeld, 1887, pl. xix, fig. 19), also from Port Chalmers, has the same appearance macro- and microscopically as the lectotype of *Spongia ramosa*, but the branches are twice as thick, the oxea are ·06 mm. long, though having the same characteristic shape, and the toxa, up to ·06 mm. chord, are abundant. The third specimen (B.M. 86.8.27.433), from Torres Straits, Australia, is indistinguishable externally from the second specimen and has the same arrangement of the fibres in the skeleton. Toxa are, however, absent, and the oxea measure only ·04 by ·002 mm., as against ·06 by ·004 mm. The oxea have not, moreover, the abruptly-pointed ends, but every now and then one finds an occasional stouter oxeote with the characteristic shape. In all probability these two specimens are conspecific, yet, according to present ideas, one is a *Ceraochalina* and the other a *Toxochalina*. Whether they can really be considered identical is a little doubtful on account of the geographical separation, but this is a point to which reference will be made later. At all events, specimen 2, the figured specimen, is the lectotype, and this is certainly identical with *Chalina* (*Spongia*) *ramosa* (= *Callyspongia ramosa*, Gray, on account of the structure of the dermal skeleton).

Since Lendenfeld's time, Brøndsted has described several species from New Zealand. One of these, *Toxochalina chalmeri*, from Port Chalmers, is, although I have not seen the specimen, unquestionably identical with the lectotype of *Ceraochalina levis*, Lendenfeld (= *Callyspongia ramosa* (Gray)). Similarly, there can be no question that *Toxochalina difficilis*, Brøndsted, from Carnley Harbour, New Zealand, is also of the same identity, although the oxea measure ·08 by ·009 mm. Moreover, *Pachychalina affinis*, a piece of which I have been able to examine, through the kindness of Dr. Brøndsted, differs from the type of *Callyspongia ramosa* only in that the meshes of the dermal skeleton are larger, and the oxea measure ·07 by ·006 mm. The latter have, however, the characteristic shape, the ends being more pronouncedly abrupt than is shown in Brøndsted's figure (1924, p. 454, fig. 13). Further, the typical toxa are present, though in very small numbers, but because there are so many foreign spicules in (or on ?) the dermis of this specimen, their significance was not readily apparent.

It will be useful at this juncture to quote Brøndsted's remarks, made *à propos* of his *Toxochalina difficilis* : " Here we have one of the many cases where the difficulties in classifying amongst the *Monaxonida* are clearly seen. The structure of the skeleton as well as the shape of the oxea are exactly as in *Chalina* ; while the sponge, if the microscleres are to be decisive for classification, is to be included amongst the *Gelliinae*.

" Although it is most natural, in my opinion, to place *Toxochalina* among the *Chalininae*, I here still refer it to the *Gelliinae* which I find most practical. As well known, it is impossible to find a usable limit between ' greater ' and ' lesser ' amount of spongin, while the diagnosis ' microscleres present ' and ' microscleres absent ' is an absolute distinction, and therefore practical. Sooner or later the genus, however, will be included among the *Chalininae ;* we often see that microscleres appear in separate groups independent of one another, groups in which the primordial forms all are devoid of microscleres. But as yet it would be to break up the well-defined *Chalinine*-group, if we include in it the genus *Toxochalina*." The following observations will show how justified are these remarks, and will perhaps clear up some of the doubts expressed therein. On one point, however, I disagree with Brøndsted—that concerning the value of the presence or absence of microscleres as a diagnostic feature. This is not an " absolute distinction " as the present paper shows, and as I have seen over and over again in examining specimens in the British Museum collection. Indeed, it is to the acceptance by nearly all authors of this false premise that so many of our difficulties are due.

Returning now to the synonymy of *Callyspongia ramosa* (Gray), it happened that in examining the types of *Ceraochalina levis*, Lendenfeld, my attention was drawn to the similarity to Gray's species of many of the species described by Lendenfeld in his ' Chalineen des Australischen Gebietes,' the book on which our present classification of the Chalininae (if not the Haploscleridae) is mainly based. Subsequent investigations, the results of which are given below, showed that many of these species are undoubtedly synonymous with *Callyspongia ramosa :*

1. *Cladochalina dendroides* (Port Chalmers) : External form typical, but branches slightly flattened. Margins of oscules produced into collar-like extensions. Skeleton generally typical, but dermal skeleton echinated. Oxea, of characteristic shape, ·07 by ·006 mm., and toxa abundant, up to ·07 mm. chord. Lendenfeld overlooked the toxa, which are very conspicuous, and described the megascleres as " Oxyus gerade . . . 0,05 mm. lang und 0,004 mm. dick."

2. *Cladochalina mammillata* (Port Chalmers) : Described as " Unregelmässig lappige Schwämme mit Erhebungen, auf deren Gipfel . . . weiten Oscula liegen " The

truth is that the type (and only specimen!) has virtually the same shape as *Cladochalina dendroides*, but the branches have coalesced and the oscules become mammilliform. The skeleton is typically that of *Callyspongia ramosa*, with a few toxa present. The oxea are mainly ·07 by ·003 mm. (not ·053 by ·005 as Lendenfeld says), with here and there stouter forms, ·07 by ·006 mm. (*cf. supra*, *Ceraochalina levis* specimen 3, p. 604).

3. *Cladochalina tenuirhaphis* (Port Chalmers): This provides a striking transition from a form like *Cladochalina dendroides* to *C. mammillata*, the coalescence of the branches being only partial. The same dermal skeleton is present as in those two species, and in every way the identity of *C. tenuirhaphis* with *Callyspongia ramosa* is obvious. The only differences of note are the absence of toxa and a variability in the size of the oxea. These vary from ·07 by ·002 mm. to ·07 by ·005 mm. (according to Lendenfeld they are all ·05 by ·002 mm.), the thickest being as numerous as the thinnest, and all transitions between the two extremes being present. Moreover, the thicker spicules have the characteristically abrupt points.

4. *Pachychalina paucispina* (New Zealand; no other locality given): It will always be a mystery why Lendenfeld should have named this species "*paucispina*." The external form is practically identical with that of specimen B of *Spongia ramosa*, Gray (*cf.* Dendy, 1897, pl. xxxiii, fig. B), and the skeleton also, except that the oxea measure ·07 by ·007 mm. and toxa are abundant.

5. *Pachychalina ramulosa* (New Zealand; no other locality given): (*a*) Var. *lamella*. If we could imagine specimen B of *Spongia ramosa*, Gray, with more numerous and broader branches, some of which had coalesced at certain points, we should have a specimen identical with the type of *Pachychalina ramulosa*, var. *lamella*. For the rest, all features agree with those of the lectotype of *Callyspongia ramosa*, except that the oxea measure ·07 by ·003 to ·005 mm. (*b*) Var. *digitata* is absolutely typical of *Callyspongia ramosa*, except that the oxea measure ·06 by ·005 mm.*

6. *Pachychalina macrospina* (Port Chalmers): The naming here is an even greater mystery! The surface throughout is smooth, even, and totally devoid of spines. Lendenfeld describes the sponge as "Klein, abgeflacht". In reality, the type consists of two small fragments of a flattened branch such as might have belonged to a specimen like *P. ramulosa*, var. *lamella* (see above). The skeleton is quite typical, the oxea measuring ·07 by ·004 mm. for the most part, with occasional forms measuring ·07 by ·007 mm. Lendenfeld gives as measurements, ·059 by ·007 mm., and says the spicules are "Nicht sehr zahlreich." This last statement may have been in comparison with a totally different type of "*Pachychalina*" in which the fibres were multispicular. Certainly, the spicules in *P. macrospina* are as numerous as in *Callyspongia ramosa*. Toxa, too, may be found, but rarely.

7. *Pachychalina elegans* (Port Chalmers): The species is intermediate between the lectotype of *Callyspongia ramosa* and *Pachychalina ramulosa*, var. *lamella*, in external form (*cf.* Lendenfeld, 1887, pl. xix, fig. 18); and the skeleton is typical, except that toxa are abundant and the oxea measure ·06 by ·004 mm. Lendenfeld says the oxea are "zahlreich", but again, this must be the result of comparison with a totally different type of sponge.

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* In this specimen the oxea are often converted to styli or stronglya by the rounding off of one or both ends. This feature may also be seen in every specimen so far discussed, though to a variable extent.

8. *Pachychalina rigida* (New Zealand, no other locality given): This is another semi-lamellate form (*cf*. *P*. *elegans* and *P ramulosa*, var. *lamella*; see also Lendenfeld, *l. c.*, pl. xix, fig. 14). The skeleton is typical, except that the oxea are differentiated into two sizes, ·06 by ·004 and ·07 by ·008 mm., with occasional intermediates, and toxa are abundant. The specimen is less rigid than most of those discussed so far, and of a softer texture than any!

9. *Ceraochalina papillata*, var. *macropora* (New Zealand; no other locality given): The type differs from the lectotype of *Callyspongia ramosa* in having slightly more flattened branches, with more numerous oscules, which are, however, of the same diameter. The skeleton is typical, except that the oxea measure ·06 by ·003 to ·005 mm.

10. *Ceraochalina papillata*, var. *intermedia* (Port Chalmers): The only differences between the type of this variety and the lectotype of *Callyspongia ramosa* are that the branches are double the size, the dermal skeleton is echinated (as in one of the paratypes), and the oxea measure ·06 by ·003 mm.

11. *Ceraochalina papillata*, var. *micropora* (New Zealand; no other locality given): The type is a smaller specimen than that of the var. *macropora*, and the oscules have, in some cases, collar-like margins. If anything, the oscules are smaller, but not sufficiently so to justify a distinction into micro- and macroporous varieties.

12. *Ceraochalina levis* (Port Chalmers and Torres Straits): See above, p. 604.

13. *Ceraochalina microrhaphis* (Port Chalmers): This species differs from *Pachychalina ramulosa*, var. *lamella*, in one feature only—that the fibres of the dermal skeleton are echinated (*cf*. p. 603).

14. *Ceraochalina multiformis*.

(*a*) Var. *moeandra* (Port Chalmers): Lendenfeld's description of this variety and the name he gives it is misleading. The type consists of five flattened branches, arising from a common base, which have coalesced in somewhat irregular manner, giving rise to a sub-clathrous rather than a maeandrine individual. The form of the sponge is, however, typical but irregular. The skeleton is typical, with oxea usually ·04 by ·003 mm., but varying in diameter up to ·007 mm. and no toxa. The dermal skeleton is echinated.

(*b*) Var. *lamella* (New Zealand; no other locality given): The type is flabellate, with prominent oscules around the margins; such a specimen as might be formed by the fusion of a number of long tubes lying in one plane. At first sight, one is inclined to regard this sponge as belonging to different species from that under discussion, but there can be little doubt that it is merely an aberrant form of *Callyspongia ramosa* (Gray). The skeleton is practically identical with that of the lectotype of Gray's species, and with transitions to this flabellate form to be found already (*cf*. *Pachychalina ramulosa*, var. *lamella*), there is little need for doubt that *Ceraochalina multiformis*, var. *lamella*, must also be regarded as a synonym of *Callyspongia ramosa*.

(*c*) Var. *digitata* (Port Chalmers, Chatham Islands): The specimen from Port Chalmers is intermediate in external form between *Cladochalina tenuirhaphis* and *Cladochalina mammillata* (see above). Actually, one face of the sponge is identical in appearance with the first species and the other side with the other species. The skeleton is typical, the oxea measuring mostly ·07 by ·002 mm., but with numerous forms measuring ·007 mm. thick. The specimen from Chatham Islands (see Lendenfeld, 1887, pl. xix, fig. 20) is sub-flabellate and consists of flattened branches lying in one plane, many of the branches being fused for the greater part of their length. The skeleton is identical with that of the Port Chalmers specimen.

(*d*) Var. *mollis* (Port Chalmers): The external form is not "fächerformig," but practically identical with that of *Cladochalina tenuirhaphis* (see above). The skeleton is typical, and the oxea ·06 by ·003 mm.

(*e*) Var. *dura* (Port Chalmers): The external form is flabellate and very like that of *Ceraochalina microrhaphis* (see above). The skeleton is quite typical and the oxea measure ·06 by ·003 to ·008 mm. (not ·0009 as stated).

15. *Ceraochalina reteplax* (Port Chalmers): The type is a piece of a branch, larger than is usual for *Callyspongia ramosa*, but showing all the essential characteristics of that species. The skeleton is typical; the dermal skeleton is echinated, the oxea are of two sizes, ·07 by ·003 mm. and ·07 by ·007 mm., and the toxa are very rare.

16. *Ceraochalina euplax* (New Zealand, according to a label on the specimen): This again is an aberrant form, the shape being flabellate (*cf. C. multiformis*, var. *lamella*, *C. ramosula*, var. *lamella*, etc.). Nevertheless, the skeleton is typical, and the toxa are present, and from a consideration of all its characters there can be no doubt that the type of this species must be considered identical with *Callyspongia ramosa*.

17. *Ceraochalina extrema* (Port Chalmers): This species, like *Pachychalina macrospina*, is described from a small fragment of what must have been a typical specimen of *Callyspongia ramosa*. The author's description and measurements are very incorrect. For example, the spicules are ·008 mm. thick, not ·0008 mm., as stated.

18. *Dactylochalina candelabrum* (Port Chalmers): The type is essentially like the lectotype of *Spongia ramosa*, with the same dermal skeleton, oxea of typical form, ·07 by ·005 mm., and abundant toxa.

19. *Euchalinopsis minima* (Port Chalmers, Port Phillip, S. Australia and Torres Straits, N. Australia). The first specimen, from Port Chalmers, has the external form of specimen D (*Chalina ramosa* (Gray), Dendy, 1898, pl. xxxiii), but in all other respects resembles the lectotype of Gray's species, except that the oxea measure ·055 by ·002 to ·005 mm. The Port Phillip specimen is indistinguishable in every respect from the Port Chalmers specimen, while the Torres Straits specimen agrees with Dendy's (1905) specimen of *Chalina subarmigera* (= *Callyspongia bullata* (Lamarck)), except that it has no toxa.

20. *Euchalina paucispina* (Port Chalmers, Port Phillip, Port Jackson): The first specimen, the lectotype, from Port Chalmers, is a typical *Callyspongia ramosa* (Gray) with occasional toxa; the second, from Port Phillip, is also typical, but has very slender oxea and no toxa; and the third, from Port Jackson, is typical in every way, with very abundant toxa. In the third specimen, the toxa are much more abundant than the oxea, and it is incomprehensible that Lendenfeld should have overlooked them.

It has been suggested above that several of Lendenfeld's specimens from Australia might be conspecific with *Callyspongia ramosæ*; and it is therefore desirable to make sure that the species is found in waters outside those of New Zealand and the Chatham Islands. The first specimen examined in this connection gives indubitable proof of the occurrence of the species at Mauritius. *Pachychalina oculata*, Lendenfeld (1887), has the external form of *Cladochalina mammillata* (see above), and has exactly the same type of main and dermal skeletons as the lectotype of *Callyspongia ramosa*. The oxea have the characteristic abruptly-pointed ends, and measure ·06 by ·007 mm., and toxa are abundant.

Further, the specimen of *Toxochalina robusta*, Ridley, from Bahia, identified by Ridley and Dendy (1887), is indistinguishable from some of the Port Chalmers specimens of *Callyspongia ramosa* (Gray), and the same may be said of *Cladochalina nuda*, Ridley (which has abundant toxa !), from Torres Straits. *C. nuda*, var. *abruptispicula*, is also conspecific with the Port Chalmers sponges, the name "*abruptispicula*" describing well the characteristic shape of the oxea of *Callyspongia ramosa*.

Among the species described from Australia by Lendenfeld, the following are also synonymous with *C. ramosa*: from Victoria, *Ceraochalina tenella*, *Euchalina phillipensis*, *Dactylochalina australis*, *Ceraochalina multiformis*, var. *elegans*, and *Chalinopora paucispina*: from New South Wales, *Euchalina exigua*, var. *simplex*, *E. macropora*, *E. typica*, *Euchalinopsis dendroides*, *Dactylochalina conulata* and *D. mollis*: from Queensland, *Euchalina exigua*, var. *arborea*. All these species and varieties show the same characters and variation as the species described by Lendenfeld from Port Chalmers, and are obvious synonyms of *Callyspongia ramosa* (Gray). Lendenfeld's descriptions of them are often faulty and usually inadequate, and should be ignored. The only point to mention in connection with the Australian specimens is that in rare cases, when the megascleres are much reduced, their ends tend to become strongylote, but as the typical oxea are always present, though often in very small numbers, there is no taxonomic significance in this. *Ceraochalina pergamentacea*, Dendy (1924), is also a synonym of *Callyspongia ramosa*, the specimen being typical in structure and possessing toxa.

The distribution of *Callyspongia ramosa* also extends to the Antarctic, as is shown by a typical specimen from McMurdo Sound in the British Museum collection, and by the fact that *Cladochalina dendyi*, Burton (1929), is synonymous with it.

The sponge wrongly identified by Dendy (1924, p. 328) as *Siphonochalina communis* differs from *Callyspongia ramosa* in one respect only—that the external form is tubular, and it is very probable that this, too, must be considered a synonym of Gray's species.

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INDEX

PAGE
Acanthella 565
Acervochalina 529
aculeata, Clathria 558
Adocia 528, 534
adriatica, var. quarnerensis, Spongia 575
affinis, Pachychalina 603
agglutinans, Ancorina 522
alba-bidens, Cinachyra 523
alba-obtusa, Cinachyra 523
alba-tridens, Cinachyra 523
alcyoncellum, Sycandra 520
Alemo 568
allociada, Cinachyra 523
Amniscos 568
amorpha, Cacospongia 602
Amorphina 534
Amphitethya 526
anchorata, Axos 547, 549
anchorata, Desmapsamma 547
anchorata, Fibularia 547
anchorata, Plumocolumella 549
Ancorina 522
andrewsi, Pseudosuberites 567
angulatus, var. canaliculata, Gellius 538
angulifera, Clathria 599
annulata, Euplacella 598
annulata, Phylosiphonia 598
annulata, Siphonochalina 597, 598
anomala, Echinochalina 600, 563
Anomodoryx 554, 555
Anomomyxilla 554, 555
antarctica, Dendrilla 595
Antherochalina 558
Antheroplax 572
apion, Cinachyra 523
Aplysilla 595
Aplysillidæ 595
Aplysina 594
Aplysinidæ 593
aplysinoides, Halichondria 564
aphroditella, Hippospongia 577
aplysinoides, Trachyopsis 564
arborea, Sycandra 520
arenosa, Desmacidon 554
armata, Mycale 547
armigera, Cladochalina 540
aruensis, Hircinia 580
Astrosclerophora 521
aurivillii, Spirastrella 571
aurivillii, var. excavans, Spirastrella 570, 571

PAGE
aurivillii, var. libera, Spirastrella 571
australiensis, Chondrilla 522
australiensis, Cinachyra 523
australiensis, Clathria 599
australiensis, Ophlitaspongia 562, 563
australiensis, Tetilla 523
australiensis, Wilsonella 599
australis, Dactylochalina 540
australis, Euplacella 598
australis, Pachychalina 598
australis var. fovea, Stelospongia 602
avara, Spongelia 583
axialis, Siphonochalina 541
Axinellidæ 564
axinelloides, Ophlitaspongia 599

Basta 596
basta, Spongia 596
Batzella 554
bilamellata, Cavochalina 598
bilamellata, Spongia 598
birotula, Halichondria 553
bispiculata, Protophlitaspongia 562
bispiculata, Siphonochalina 562
borealis, Spuma 600
brassicata, Haliclona 597
brassicata, Phakellia 597
brassicata, Reniera 597
bullata, Tuba 543

Cacospongia 602
cactiformis, Acanthella 565
cactiformis, Rhaphoxya 565
cactus, Aplysilla 595
cactus, Spongelia 595
cæspitosa, Aplysina 595
calcifera, Histoderma 548
Callyspongia 528, 539
camerata, Haliclona 531
camerata, Reniera 531
canaliculata, Hippospongia 577
canalis, Euryspongia 602
canalis, Stelospongia 602
candelabrum, Corticium 521
candelabrum, Dactylochalina 603
carcinophila, Chondropsis 552
carcinophila, Sigmatella 552
carotta, Rhizochalina 546
carterianum, Desmacidon 547
Carterispongia 572, 573

PAGE
carteri, var. heteroraphis, Pericharax 518
cavernosa, Acanthella 565
cavernosa, Cacospongia 595
cavernosa, Dendrilla 595
Ceraochalina 539
Chalina 529, 554
chaliniformis, Chondropsis 552
chaliniformis, Desmacidon 554
chaliniformis, Dysidea 552, 556
chaliniformis, Phoriospongia 552
Chalinodendron 529
Chalinopora 534
Chalinorhaphis 529
Chalinula 529, 531
chalmeri, Toxochalina 603
chilensis, Spongelia 595
Chondrilla 522
Chondropsis 552
Chondrosiidae 522
Chrotella 523
Cinachyra 523
Cinachyrella 523
cinachyroides, Tetilla 523
cinerea, Adocia 535
cinerea, Dysidea 583
cinerea, Halichondria 535
cinerea, Isodictya 535
cinerea, Reniera 535
cinerea, Spongelia 583
cinerea, Spongia 535
Ciocalypta 564
Cladochalina 539
clathrata, Callyspongia 543
clathrata, Carterispongia 574
clathrata, Chalina 543
clathrata, Haliclona 532
clathrata, Hircinia 574
clathrata, Hyatella 574
clathrata, Reniera 532
Clathria 558
Clathrieae 557
claviformis, Acervochalina 535
clavigera, Cinachyrella 523
clavigera, Tethya 523
clavosa, Stelletta 522
Clavulidae 569
cliftoni, Axos 549
Cliona 570
coccinea, Axinella 553
coccinea, Iotrochota 553
Coelocarteria 563
Collocalypta 564
columella, Desmacidon 554, 556
columella, Hemimycale 556
Columnitis 568
communis, Chalinissa 597
communis, Euplacella 598
communis, Tubulodigitus 536

PAGE
communis, var. digitata, Chalinissa 598
communis, var. flabellum, Chalinissa 598
concentrica, Antherochalina 558
confoederata, Callyspongia 541
confoederata, Siphonochalina 541
confoederata, Spinosella 541
confoederata, Tuba 541
conica, Pellinella 536
connectens, Wilsonella 599
conulata, Dactylochalina 603
coralliophila, Tenacia 560
coriacea, Dysidea 583
corticata, Batzella 554, 557
Corticium 521
costifera, Stelospongia 602
cranium, var. australiensis, Tethya 523
crassa, Antherochalina 558
crassifibra, Siphonochalina 541
Crella 553, 600
cribriporosa, Plumocolumella 555
cruor, Aplysina 595
cymaeformis, Chalina 532

Dactylochalina 539
deliculata, Spongelia 593
Dendrilla 595
dendroides, Cladochalina 603
dendroides, Euchalinopsis 603
dendroides, Hircinia 580
dendroides, var. dura, Cacospongia 580
dendroides, var. friabilis, Cacospongia 580
dendyi, Cladochalina 603
dendyi, Desmacidon 554
dendyi, Homoeodictya 554
dendyi, Phyllospongia 572
dendyi, var. digitata, Phyllospongia 573
dendyi, var. frondosa, Phyllospongia 573
Desmacidon 554
Desmacidonidae 547
Desmapsamma 547
difficilis, Toxochalina 603
diffusa, Callyspongia 540, 541
diffusa, Cladochalina 541
digitata, Spongelia 593
Diplodemia 529
Ditela 574
Donatia 568
Druinella 594
dubium, Cornulum 558
dubium, Paracornullum 558
dura, Antherochalina 558
durissima, Pseudoceratina 595
Duseida 582
Duseideia 582
Dyseideia 582
Dysidea 582
Dysidia 582
Dysidicinia 578

PAGE
eccentrica, Ophlitaspongia 560
echinata, Hircinia 579
Echinochalina 562
Echinoclathria 558, 562
elastica, Petrosia 546
elastica, Reniera 546
elastica, Siphonochalina 541
elastica, Spongelia 583, 593
elegans, Antherochalina 558
elegans, Carterispongia 600
elegans, Chalinissa 598
elegans, Cladochalina 541
elastica, Oceanapia 546
elegans, Pachychalina 603
elegans, Phyllospongia 600
elegans, Phylosiphonia 597
elegans, Psammochela 550
elegans, Spongelia 583
elegans, Syringella 558
elongata, Chalinissa 598
elongata, Pachychalina 597
enigmatica, Raphidotethya 526
equina, Euspongia 601
equina, Hippospongia 577
equina, Spongia 575, 601
eschrittii, Callyspongia 539
Euchalina 539
Euchalinopsis 529
Euplacella 597
euplax, Ceraochalina 603
Euricinia 578
Euryspongia 602
Euspongia 574
exigua, var. arborea, Euchalina 603
exigua, var. simplex, Euchalina 603
exigua, Haliclona 532
exigua, Petrosia 532
extensa, var. dura, Siphonochalina . . . 541
extensa, var. elegans, Siphonochalina . . . 541
extrema, Ceraochalina 603

fallax, Callyspongia 539
Fasciospongia 602
fenestratus, Hymeniacidon 564
fenestratus, Leucophloeus 564
fertilis, Chalinula 531
fibrosa, Callyspongia 540
fibrosa, Dasychalina 540
fibrosa, Pachychalina 540
fibrosa, Phoriospongia 550
fibrosa, Psammochela 550
fibulata, Axos 549
fibulatus, Gelliodes 549
fibulatus, Gellius 537
fibulatus, var. microsigma, Adocia . . . 539
Filifera 578
finitima, Acervochalina 541
fistulosa, Oceanapia 546

PAGE
fistularis, Spongelia 583
flabellata, Phakellia 558
flabelliformis, Axos 549
flabelliformis, Basta 596
flabelliformis, Ianthella 595
flabelliformis, Spongia 596
flabelliformis, Verongia 596
flabello-digitatus, Haliclona 534
flabellipalmata, Sigmatella 599
flabellopalmata, Hircinia 599
flabellopalmata, Tedaniopsamma . . . 599
foliascens, Carterispongia 573
foliascens, Phyllospongia 573
foliascens, Spongia 572, 573
folioides, Desmacidon 540
fortis, Siphonochalina 540
fovea, Fasciospongia 602
fragilis, Duseideia 583
fragilis, Dysidea 583
fragilis, Oceanapia 547
fragilis, Spongelia 552, 583
fragilis, Spongia 583
frondifer, Amphilectus 559
frondifera, Clathria 559
frondifera, Halichondria 559
frondifera, Tenacia 559
frondosa, Antherochalina 558
frondosa, Clathria 558
frondosa, Euplacella 598
frondosa, Hippospongia 582
fuliginosum, Holopsamma 595

Geelongia 572
gelatinosum, Alcyoncellum 520
gelatinosa, Grantia 520
gelatinosum, Sycidium 520
gelatinosum, Sycon 520
Gellius 529, 530
gigantea, Hircinia 578
glabra, Echinochalina 600
glabra, Echinoclathria 600
gracilenta, Chalina 530
gracilis, Echinoclathria 563
grandis, Mycale 547
grossa, Reniera 536

haeckelii, Ceratodendron 577
Halichondria 600
halichondrioides, Trachyopsis 564
Haliclona 528, 529
Halispongia 600
Hamigera 549
hebes, Tethya 523
Hemimycale 554, 556
herbacea, Dysidea 593
herbacea, Spongelia 593
Heteropiidae 520
heteroraphis, Pericharax 518

PAGE
Hippospongia 574
Hircinella 578
Hircinia 578
Histoderma 548
Holopsamma 595
Homoscleropbora 521
Hymedesmia 557

Ianthella 596
ianthelliformis, Dendrilla 595
ibis, Chrotella 523
inaequalis, Batzella 550, 554
inaequalis, Strongylacidon 550
inconstans, Spirastrella 570
inconstans, var. digitata, Spirastrella 570
inconstans, var. globosa, Spirastrella 570
inconstans, var. maeandrina, Spirastrella 570
incrustans, var. digitata, Crella 600
incrustans, Spongelia 583
incrustans, Myxilla 529
inops, Batzella 554
intermedia, Echinochalina 563
intermedia, Echinoclathria 563, 600
intermedia, Strongylacidon 550
Iotrochota 553
irregularis, Cacospongia 578
irregularis, Hircinia 578
irregularis, var. pertusa, Euspongia 577
irregularis, Thorectopsamma 557, 569, 577
Ircinia 578
isis, Cinachyra 523
Isodictya 554
Isodictyeae 547

japonica, Donatia 568
japonica, Tethya 568
Jaspis 522
jugosa, Isodictya 530
jugosus, Gellius 530

Keratosa 572
kükenthali, Cinachyra 523

lactea, Euryspongia 602
laevis, Tethyorrhaphis 568
laxa, Siphonella 541
Laxosuberites 567
Leucascidae 518
Leuconia 520
Leucophloeus 564
levis, Ceraochalina 603
lignea, Spongia 601
limbata, Chalina 529
lindgreni, Tetilla 523
Luffariella 593
Lyncuria 568
lyncurium, Tethya 568

PAGE
macropora, Euchalina 603
macrospina, Pachychalina 603
malaccensis, Cinachyra 523
mammillata, Chalinopora 603
massa, Aplysina 595
Mauricea 572
megasclera, Polymastia 567
membranosa, Aplysina 595
membranosa, Dendrilla 595
membranosa, Spongia 595
mertoni, Cinachyra 523
mertoni, Collocalypta 564
mertoni, Dendrilla 595
mertoni, Hymedesmia 557
microrhaphis, Ceraochalina 603
minima, Euchalinopsis 603
minor, Adocia 537
minor, Chalina 541
mollis, var. aruensis, Aplysina 594
mollis, Batzella 554
mollis, Dactylochalina 603
mollissima, Euplacella 598
mollissima, Spongia 601
montagui, Chalina 534, 535
mucosa, Tedania 529
mucronata, Polysiphonia 531
multiformis, var. digitata, Ceraochalina 541, 603
multiformis, var. dura, Ceraochalina 603
multiformis, var. elegans, Ceraochalina 603
multiformis, var. lamella, Ceraochalina 603
multiformis, var. maeandrina, Ceraochalina 603
multiformis, var. manaarensis, Ceraochalina 541
multiformis, var. manaarensis, Pachychalina 541
multiformis, var. mollis, Ceraochalina 603
Mycale 547
Mycaleae 547
Myxilla 529
Myxilleae 548

nardorus, Aphrodite 577
nardorus, Spongia 577
nigra, Dysidea 583
nodosa, Echinoclathria 562
noevus, Aplysina 595
nucula, Chondrilla 522
nuda, Cinachyra 523
nuda, Cladochalina 540, 603
nuda, var. abruptispicula, Cladochalina 603
nuda, var. oxystrongylus, Ceraochalina 603
nuda, var. oxyus, Ceraochalina 603

obtusa, Adocia 537
obtusa, Gelliodes 537
obtusispiculifera, Chalina 532
Oceanapia 545
oculata, Chalina 529
oculata, var. novae-zealandiae, Chalina 603
oculata, Halichondria 529

PAGE
oculata, Pachychalina 603
oculata, Spongia 529
officinalis, Spongia 575, 576, 601
officinalis, var. adriatica, Spongia 575
officinalis, var, arabica, Euspongia 577
officinalis, var. ceylonensis, Euspongia 577
officinalis, var. dura, Euspongia 601
officinalis, var. mollissima, Spongia 601
oleracea, Rhizochalina 546
Ophlitaspongia 560
Orina 529, 534
Oscarella 521
otahitica, Carteriospongia 573
otahitica, Spongia 572
oxeata, Protophlitaspongia 562
oxyaster, Tethyorrhaphis 568

palmata, Dysideopsis 593
pallescens, Spongelia 583
pallasi, Aplysina 595
palmata, Chalina 541
palmata, Isodictya 554
panicea, Halichondria 536, 600
papillaris, Spongia 600
papillata, var. intermedia, Ceraochalina 603
papillata, var. macropora, Ceraochalina 603
papillata, var. micropora, Ceraochalina 603
papyracea, Spongia 572
Paracornulum 558
Pararhaphoxya 565
patifera, Cinachyrella 523
Patuloscula 539
paucispina, Chalinopora 603
paucispina, Euchalina 603
paucispina, Pachychalina 603
paucispinus, Rhaphidophlus 559
paucispina, Siphonochalina 541
paucispina, Tenacia 559
pedunculata, var. dura, Placochalina 598
pedunculata, var. mollis, Placochalina 598
pedunculata, var. poculum, Placochalina 598
Pellina 534
Pellinella 534
penicillus, Ciocalypta 564
Pericharax 518
perforata, Antherochalina 558
perforata, Spongelia 583
pergamentacea, Ceraochalina 603
Petrosia 539
peziza, Pericharax 518
phakellioides, Halichondria 600
phillippensis, Euchalina 603
Philotia 529
Phloeodictyon 545
Phyllospongia 572
Phylosiphonia 529
pigmentifera, Haliclona 533
pigmentifera, Reniera 533

PAGE
pinna, Hircinia 579
Placochalina 597
Plakinidae 521
plicatum, Desmacidon 554, 555
Plumocolumella 549, 555
poculifera, Tetilla 523
poculum, Cribrochalina 598
polychotoma, var. trichotoma, Chalina 603
Polymastia 567
polymorpha, var. infundibuliformis, Veluspa 558
Polysiphonia 529
Polytherses 578
porosa, Gelliodes 537
porosa, Spiretta 523
porosa, Tetilla 523
praetensa, Aplysina 595
Prianos 529
procera, Clathria 559
procera, Tenacia 559
procumbens, Patuloscula 539
proteus, Laxosuberites 567
Protophlitaspongia 562
providentiae, Cinachyra 523
Psammaplysilla 595
Psammochela 550
Psammocinia 578
psammodes, Desmacidon 555
Psammodoryx 554, 556
Pseudoceratina 595
Pseudosuberites 567
purpurea, Aplysina 594
purpurea, Druinella 594
purpurea, Halichondria 553
purpurea, Iotrochota 533, 553
purpureum, Psammopemma 594
purpurea, Stelletta 521
pulchella, Spongionella 572
pulcherrima, Stelospongia 602
pulvinatus, Chalina 541
pumila, Adocia 537
pumila, Siphonochalina 537

ramodigitata, Hircinia 580
ramosa, Callyspongia 540, 596, 597
ramosa, Chalinissa 541, 598
ramosa, Druinella 595
ramosa, Hircinia 579
ramosa, Leuconia 520
ramosa, Pachychalina 597
ramosa, Spongia 597
ramulosa, var. digitata, Pachychalina 603
ramulosa, var. lamella, Pachychalina 603
raphidiophora, Spiretta 523
Raphidotethya 526
Rayneria 535
Reniera 535
renieroides, Antherochalina 558
renieroides, Oceanapia 546

PAGE
reptans, Desmacidon 547
reteplax, Ceraochalina 603
retiaria, Megalopastas 595
retiarmata, Ceraochalina 541
reticulata, Dysidea 593
reticulata, Echinochalina 600
reticulata, Euchalinopsis 531
reticulata, Haliclona 531
Rhaphoxiella 554, 557
Rhaphoxya 565
Rhizochalina 545
rhizophyta, Cinachyra 523
ridleyi, Callyspongia 543
ridleyi, Gellius 537
rigida, Chalinissa 598
rigida, Euchalina 540
rigida, Pachychalina 603
rimosa, Ophlitaspongia 560
rosea, Aplysilla 595
rosea, Dendrilla 595
rosea, var. digitata, Dendrilla 595
rosea, var. typica, Dendrilla 595
rosea, Luffaria 595
robusta, Donatia 568
robusta, Tethya 568
robusta, Toxochalina 603
rubens, Clathria 558

sagittaria, Adocia 538
sagittarius, Gellius 538
sansibarensis, Strongylacidon 555
Sarcotragus 578
schistospiculosa, Cinachyra 523
schulzei, Cinachyra 523
schulzei, Hircinia 580
schulzei, Tetilla 523
scrobiculata, Callyspongia 539
semilunaris, Spirastrella 571
semitubulosa, Reniera 533
semitubulosa, Spongia 533
serpens, Chalinissa 598
Sigmatosclerophora 523
singaporense, Coelocarteria 563
singaporense, Histoderma 563
singaporense, Phloeodictyon 563
singaporensis, Rhizochalina 563
simulans, Adocia 534
simulans, Chalina 534
sinuosa, Spongia 574
Siphonella 539
Siphonochalina 534
spinifera, Chalina 540
spinifera, Spongelia 583
spinilamella, Cladochalina 540
spinilamella, Pachychalina 540
spinipoculum, Axos 549
spinipoculum, Diacarnus 549
Spinosella 539

PAGE
spinosella, Gelliodes 537
spinosissima, Pachychalina 540
spinulata, Crella 553
spinulata, Grayella 553
Spirastrella 570
Spongelia 582
Spongia 574
spongiastrum, Ircinia 578
Spongiidae 572
Spongionella 572
Spuma 600
stalagmitis, Phylosiphonia 597
stellata, Hymedesmia 569
stellata, Stelligera 569
stellata, Timea 569
Stellatta 521
Stellettidae 521
stelliderma, Desmacidon 554
stelliderma, Halichondria 554, 555
stellifera, Jaspis 522, 533
Stelospongia 602
Stelospongos 602
Stelospongus 602
Stematumenia 578
stipitata, Acanthella 565
Strongylacidon 550, 554
strongylata, Hamigera 549
strongylata, Petrosia 539
subarmigera, Callyspongia 540
subarmigera, Chalina 540
subarmigera, Chalinopora 540
Suberitidae 567
subhispida, Echinoclathria 562
subhispida, Ophlitaspongia 559
sulevoidea, Esperella 548
sulevoidea, Mycale 548
Sycettidae 520
Sycon 520

Tedania 529
Tedaniopsamma 599
Tenacia 559
tenella, Ceraochalina 603
tenuifibris, Chalinissa 598
tenuiramosa, Pararhaphoxya 565
tenuirhaphis, Chalinopora 603
tenuis, Echinoclathria 558, 562
tenuis, Ophlitaspongia 558, 599
tenuis, Oscarella 521
tenuispiculata, Haliclona 533
tenuispina, Antherochalina 558
tenuissima, Hymedesmia 557
tenuissima, Myxilla 557
ternatensis, Tetilla 523
Tethea 568
Tethia 568
Tethium 568
Tethya 523, 568

PAGE
Tethyadae 568
Tethyorrhaphis 568
Tethyum 568
Tetilla 523
Tetillidae 523
Thorectopsamma 577
Timea 569
topsenti, Dysideopsis 593
Topsentia 528
toxius, Adocia 537
toxius, Gellius 537
Toxochalina 539
Trachyopsis 564
transiens, Clathria 599
trincomaliensis, Euspongia 577
trochiformis, Cinachyra 523
Tuba 539
tuberculata, Siphonella 541
Tubulodigitus 534
tupha, Spongia 583
typica, Euchalina 603

PAGE
typica, Reniera 535
typica, Siphonochalina 541
typus, Rayneria 535

vaccinata, Cinachyra 523
vanderhorsti, Ceraochalina 539
variabilis, Luffaria 593
variabilis, Luffariella 593
variabilis, var. hirsuta, Hircinia . . . 579
varians, Isodictya 529
vasiformis, Geelongia 572
vasiformis, Reniera 597
ventilabrum, Basta 596
vermicularis, Carterispongia 573
vermicularis, Phyllospongia 573
vesicula, Diplodemia 529
viminalis, Thalassodendron 600
vulgata, Acanthella 565

zimocca, Euspongia 601
zimocca, Spongia 601

DESCRIPTION OF PLATE I.

FIGS. 1–7.—*Adocia pumila* (Lendenfeld). Figs. 1, 2, 5, natural size; figs. 3, 4, 6, slightly less than natural size; fig. 7, × $\frac{2}{3}$.

FIGS. 8, 9.—*Ophlitaspongia eccentrica*, sp. n. Natural size.

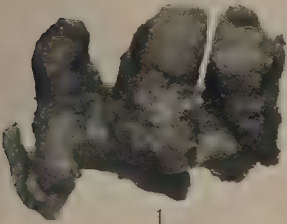
FIG. 10.—*Haliclona flabello-digitata*, sp. n. × $\frac{2}{3}$.

FIG. 11.—*Hircinia ramosa*, Keller. Natural size.

FIG. 12.—*Hircinia ramodigitata*, sp. n. Natural size.

FIG. 13.—*Echinochalina anomala*, Hallmann. Natural size.

FIG. 14.—*Haliclona reticulata*, Lendenfeld. × $\frac{2}{3}$.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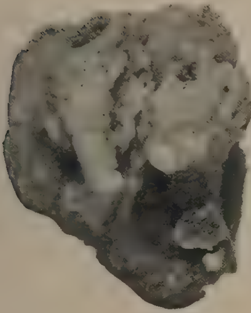
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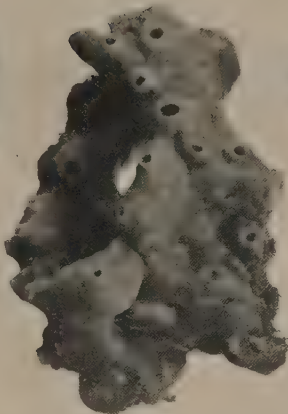
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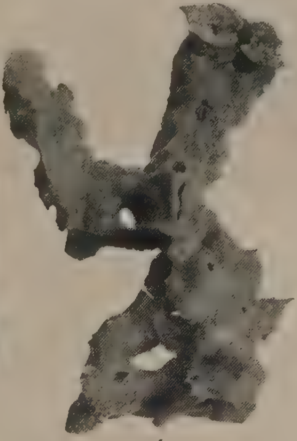
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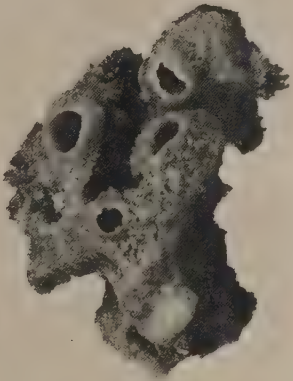
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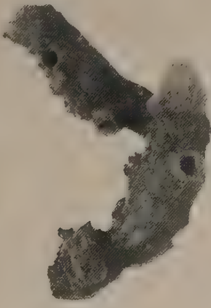
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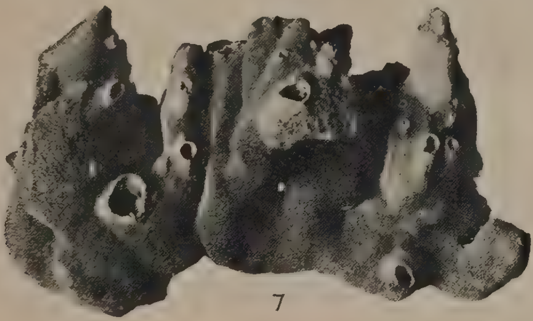
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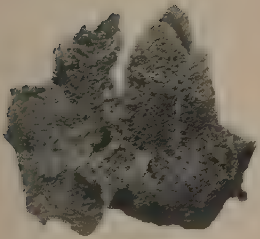
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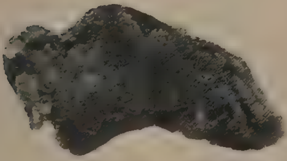
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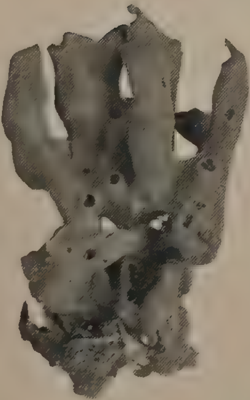
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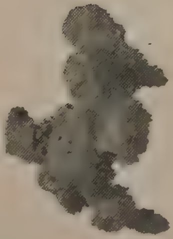
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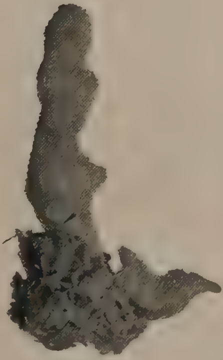
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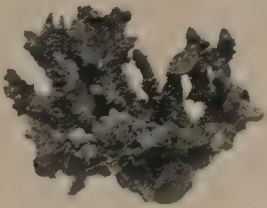
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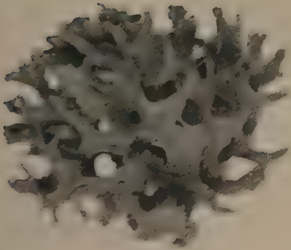
14

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DESCRIPTION OF PLATE II.

(Figures 3–10 natural size.)

FIG. 1.—*Halichondria phakellioides*, Dendy and Frederick. × ½.

FIG. 2.—*Spongelia pallescens*, var. *elastica*, Schulze's specimen (B.M. 83.12.4.26). × ⅗.

FIG. 3.—*Spongelia pallescens*, Schmidt, from the Naples Station (B.M. 25.11.1.360).

FIG. 4.—*Spongelia pallescens*, Schmidt, from the Adriatic (B.M. 67.7.26.9).

FIG. 5.—*Dysidea fragilis* (Montagu), from the English Channel (B.M. 25.11.1.1034).

FIG. 6.—*Dysidea fragilis* (Montagu), from Hastings (B.M. 81.5.5.31–3).

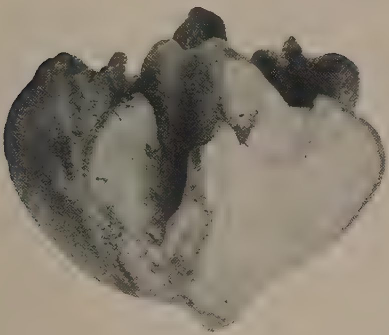
FIG. 7.—*Dysidea fragilis* (Montagu), from the "Porcupine" Collection, Stn. 4 (S.W. of Ireland: B.M. 87.7.28.12–15).

FIG. 8.—*Dysidea fragilis* (Montagu), from Sussex Coast (slightly macerated).

FIG. 9.—*Dysidea fragilis* (Montagu), from Dorset (B.M. 97.8.9.70–1).

FIG. 10.—*Dysidea fragilis*, (Montagu), from Poole (B.M. 89.7.26.7–12).

FIG. 11.—*Dysidea fragilis* (Montagu), from Norway (B.M. 10.1.1.598).



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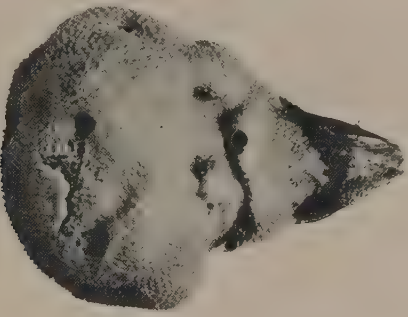

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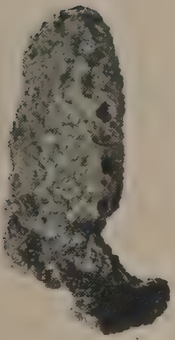

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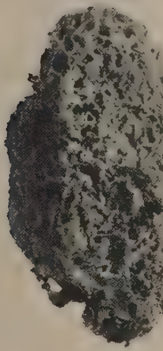

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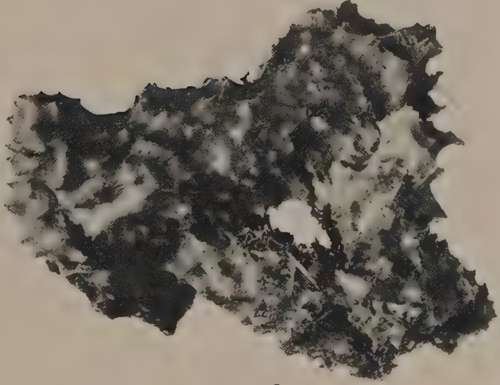

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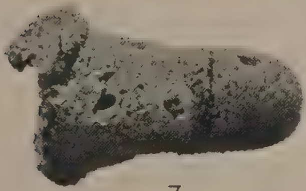

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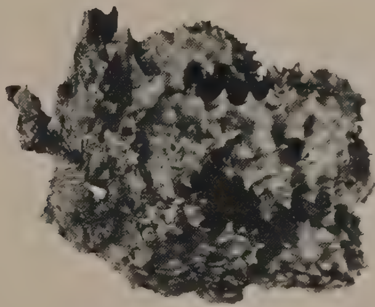

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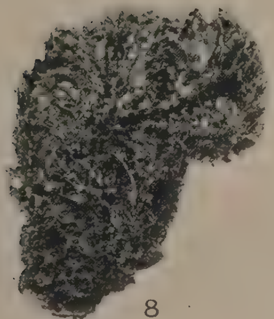

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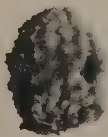

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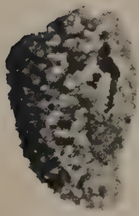

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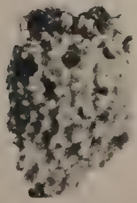

11

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INVESTIGATIONS

THE SILICOFLAGELLATA AND TINTINNOINEA.

BY

SHEINA M. MARSHALL, D.Sc.,

Naturalist, Marine Station, Millport.

WITH FORTY-THREE TEXT-FIGURES.

CONTENTS.

THE SILICOFLAGELLATA

	PAGE
Introduction	623
Anatomy	624
Descriptions of Species	629

THE TINTINNOINEA

Introduction	632
List of Species	632
Distribution	633
Descriptions of Species	634
References	662
Index	663

THE SILICOFLAGELLATA.

INTRODUCTION.

SILICOFLAGELLATES are rare in the material of the Great Barrier Reef Expedition. This is to be expected, since their small size enables them to pass through the meshes of even the finest net used, but the numerous water samples centrifuged and examined during the course of the year show that they were actually present only in very small numbers (Marshall, 1933, Vol. II, No. 5). They showed no seasonal variation, but appeared occasionally throughout the year in numbers up to 30 per litre. The specimens figured here are mainly those taken in the international fine silk net (see Russell and Colman, 1931, Vol. II, No. 2, for details of apparatus and position of stations).

Silicoflagellates have long been known from their skeletons, particularly in fossil material, but it is only comparatively recently that much attention has been paid to the protoplasmic body. They were for long considered to belong to the Radiolaria, either as members of the Acanthodesmidae (Haeckel, 1862), or as only parts of the skeleton of Radiolarians (Phaeodarian) (Hertwig, 1879, and Haeckel, 1887). In 1891, however, Borgert, working mainly on *Distephanus speculum*, proved that they were independent organisms. He described the flagellum, and separated them from the Radiolaria, making for them a special group in the Mastigophora. Recently Schulz (1928) and Gemeinhardt (1930) have published monographs on the whole group, and the latter has added considerably to our knowledge of the living form. The observations on living specimens which are given below were made on material from the Clyde sea-area, but, so far as could be ascertained, they are true also of the Great Barrier Reef specimens. Silicoflagellates are very delicate organisms, and do not live for long in the laboratory under any circumstances ; conditions on Low Isles were not favourable for their survival.

ANATOMY.

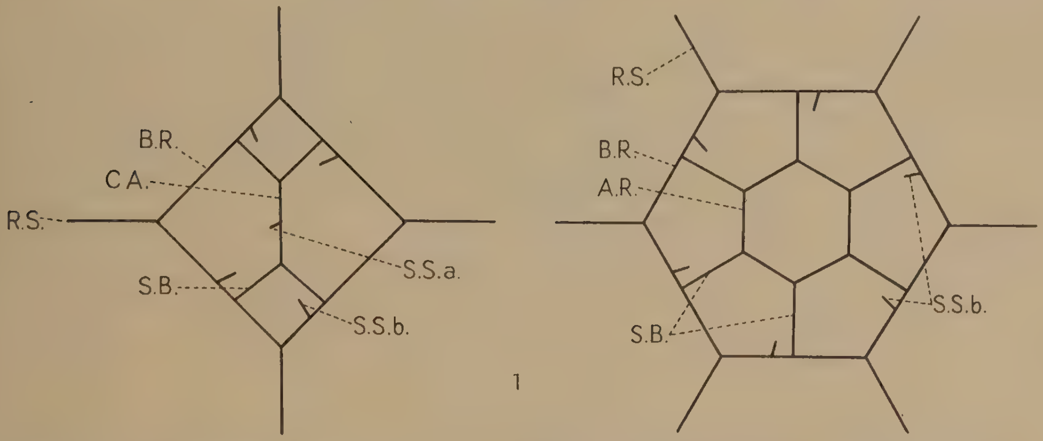
The hollow siliceous skeletons of the two living genera *Distephanus* and *Dictyocha* are similar in plan, and can be understood by an examination of Text-fig. 1. There is a basal " ring ", four-sided in the case of *Dictyocha* and six-sided in the case of *Distephanus*, from each angle of which a spine projects radially. From about the middle of each side there rises a supporting bar. In *Dictyocha* the bars from adjacent sides unite and are joined by a central arch ; in *Distephanus* the bars support a second, apical " ring ". Small spines are also present, usually one directed abapically on each of the four or six sides of the basal ring, between the radial spine and the supporting bar to the right of it, and often one or more directed apically on the central arch or apical ring.

There is a great deal of variation in the form of the skeleton. The radial spines may be long or short, they may be bifid or be absent altogether ; one side may be incomplete ; in *Dictyocha* the basal ring may be three-, four- or five-sided, and in *Distephanus* four-, five-, six-, seven-, eight- or nine-sided, with all the modifications consequent on this disturbance of the usual arrangement ; in *Distephanus* the apical ring may be absent, or it may be divided into two or more. Some of these variations (such as bifid spines or an incomplete side) are obviously mere abnormalities, while some occur so frequently and regularly as to be classed as separate varieties. In several cases the variation seems to take a form transitional between one species and another, or between one genus and another. Schulz and Gemeinhardt have divided the genera *Dictyocha* and *Distephanus* into a small number of species, each with a large number of varieties and forms.

In all the varieties described double specimens occur. These consist of two individuals with their basal rings closely apposed. They hold together firmly and are not easily detached from one another. Borgert considered these to be conjugating forms, but Gemeinhardt has shown that they are really in course of division, and he has described and figured a number of stages in the process. In such pairs the skeleton of one is often much thinner than that of the other. Nuclear division does not take place till the second skeleton is fully formed.

When mounted in canada balsam the hollow interior of the skeleton has a different refractive index from the rest of the skeleton. It looks as if it were filled with air, and this sometimes makes the examination of the nucleus difficult. Immediately after mounting the skeleton may be quite transparent, but in a short time there is the appearance of a minute bubble in one corner, and this spreads rapidly through the whole cavity of the skeleton. If, however, any part is broken, even the tip of a small spine, this bubble vanishes and the whole skeleton becomes perfectly transparent again. Lemmermann (1901) mentions this difficulty, and says that skeletons, heated on a slide, will fill with air which may be got rid of by means of alcohol, and he suggests that fine pores may be present in the skeleton. The bubble appearance comes, however, even when the specimen has never been allowed to dry. Borgert evaded the difficulty by mounting his specimens in glycerine, by which means he could make it disappear entirely.

An early description of a living Silicoflagellate was that by Johannes Müller in 1855, and it contains the following: "An den frisch beobachteten Exemplaren einer sechsstrahligen *Dictyocha* [now *Distephanus*] war das Kieselnetz von einer gelblichen organischen Substanz gefüllt, die das Netz auch auswendig überzog und verhüllte und war der Körper niemals in weiche Strahlen verlängert." This observation of his on the enveloping layer of protoplasm was unconfirmed, and indeed denied by subsequent workers until recently, but it is perfectly correct. Gemeinhardt describes and figures this "exoplasma" in *Distephanus speculum*, and it is even more clearly seen in *Dictyocha fibula*.



TEXT-FIG. 1.—Diagrams showing the skeletons of *Dictyocha fibula* (left) and *Distephanus speculum* (right), viewed from the apical side. A.R. Apical ring. B.R. Basal ring. C.A. Central arch. R.S. Radial spine. S.B. Supporting bar. ss_a. Small spines directed apically. ss_b. Small spines directed abapically.

The cell body of a *Distephanus speculum* is of clear hyaline protoplasm. As a rule it extends beyond the skeleton, forming a delicate covering over it and reaching to the tips of the spines. There it is drawn out into exceedingly fine threads or pseudopodia (Text-fig. 2). These are mobile, and are very variable, being sometimes visible on every spine, sometimes only on one or two.* In an unhealthy specimen, or in one which has been long under the coverslip, they are not to be seen at all. Occasionally two threads are visible from the tip of one spine. When in motion they swing slowly backwards and forwards, and can probably alter their form also by amœboid movement. They vary greatly in length, and may be as long as 50μ. These pseudopodia resemble the flagellum very much in appearance, except that they are usually finer and do not move in the same way. The flagellum, as a rule, comes out close to the base of a spine, and extends beyond it for a short distance. Sometimes only the tip is in active motion, sometimes the whole flagellum is thrown into waves. In a healthy living specimen the small yellowish-brown chromatophores are embedded in the protoplasm, not only within the space enclosed by the skeleton, but also outside it. They tend to collect round the bases of the spines, and give the animal a typical rosette-like appearance. In many specimens, particularly those which have been long under observation, the chromatophores are contracted into a central mass within the skeleton. The flagellum may be visible even after this has taken place. The nucleus, which is not visible in the living cell, has been described by Gemeinhardt as spherical, containing one, or occasionally two, nucleoli. Borgert describes the nucleus as oval. He states that there is an intensely staining, round, chromatin body surrounded by a lightly staining layer, which is separated by a thin membrane from the cytoplasm. My observations agree with Borgert's, except that the nucleus is usually rounded, but may be rather irregular in shape.

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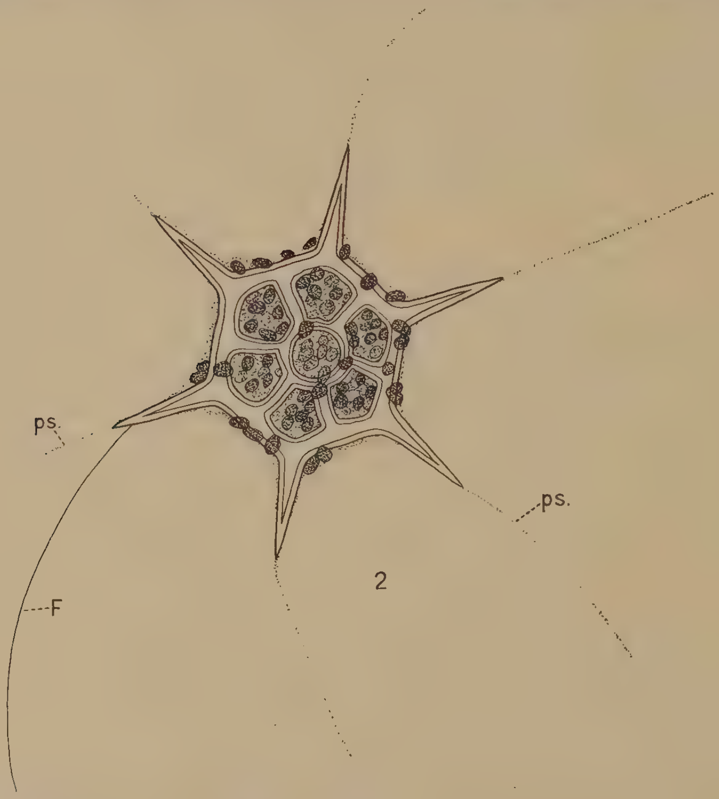
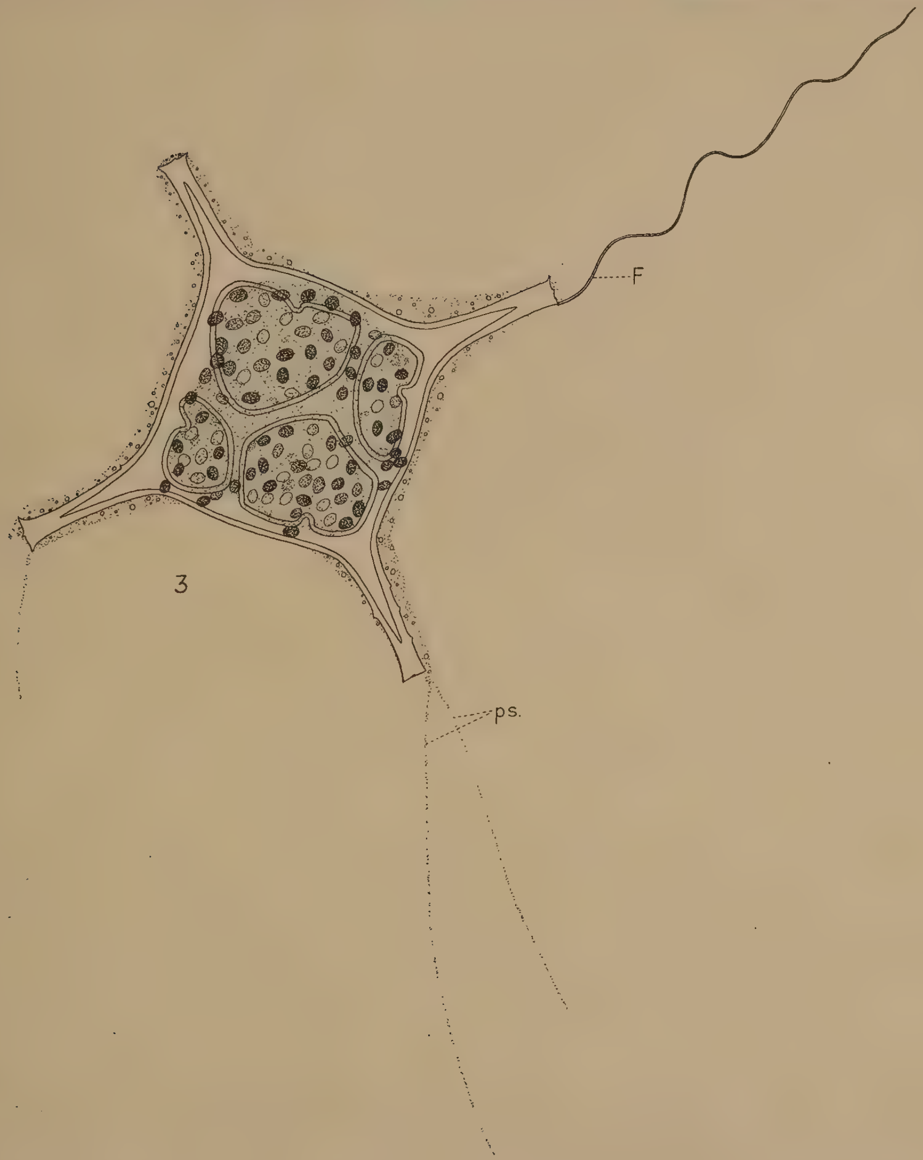
* I have found similar delicate pseudopodia extending beyond the tips of the spines in living Radiolaria (Acantharia).



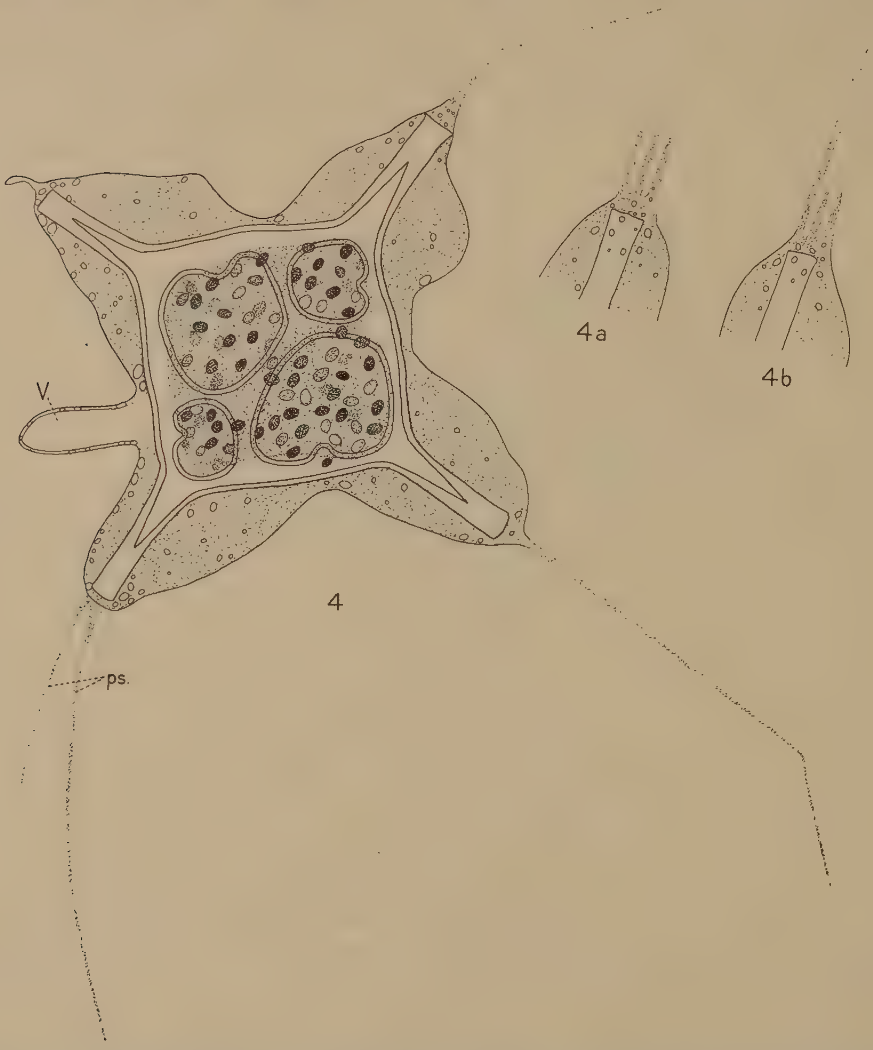
Text-fig. 2.—Living specimen of *Distephanus speculum*, showing pseudopodia (*ps.*) and flagellum (F.). From the Firth of Clyde.

In *Dictyocha fibula* (Text-fig. 3) the protoplasmic body is very similar to that of *Distephanus*. It shows the same enveloping layer, which in this case is much more obvious because it is filled with minute refractive granules, and is often more extensive. The fine pseudopodia are also seen, and these, besides showing backward and forward movements, may change their shape rapidly by amoeboid movements. A flagellum is not often seen but, when present, is similar to that found in *Distephanus*. Chromatophores similar to those in *Distephanus* are present and show the same arrangement. In one specimen observed (Text-fig. 4) the cytoplasm outside the skeleton was much more extensive than usual and showed a definite external layer, which is not commonly seen. It formed broad lobes round the spines, from the tips of which extended very mobile pseudopodia (see



Text-fig. 3.—Living specimen of *Dictyocha fibula* viewed from the abapical side showing pseudopodia (*ps.*) and flagellum (F.). From the Firth of Clyde.

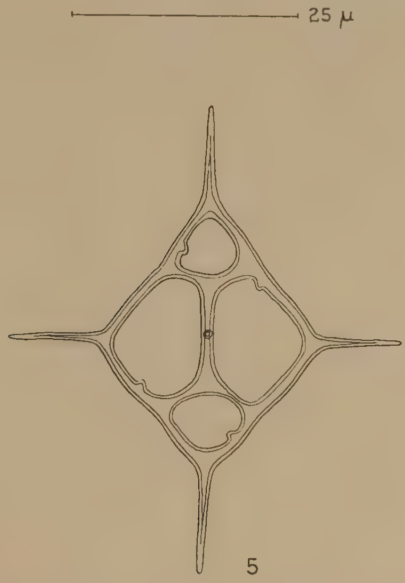
Text-figs. 4, 4*a*, 4*b*, which represent the same spine at short intervals of time). From about the middle of one side projected a long oval vacuole with a thin wall, and this remained constant in form and position for a considerable time, and even after fixation. The chromatophores were mostly massed in the centre, but the condition of the pseudopodia shows that this was a healthy specimen. Gemeinhardt states that before division the amount of protoplasm in *Distephanus* is increased, and it seems possible that this *Dictyocha* was about to divide, and that the vacuole indicated where a future spine would be laid down. If this were so, the resulting skeleton would be abnormal; but dividing forms are frequently seen, in which one member of the pair is normal and the other abnormal. The nucleus in *Dictyocha* is similar to that in *Distephanus*. It is more frequently irregular



Text-fig. 4.—Living specimen of *Dictyocha fibula* viewed from the abapical side, showing a large amount of protoplasm and a vacuole (*v.*). 4*a* and 4*b* show further alterations in the pseudopodia effected by amoeboid movement. From the Firth of Clyde.

in shape, however, and there are often small masses of darkly staining material along the membrane separating it from the cytoplasm. A more deeply staining nucleolus can sometimes be made out in the central mass.

I am indebted to Miss Brown Kelly for the drawings of Silicoflagellates.



Text-fig. 5.—*Dictyocha fibula* var. *stapedia*. From the Great Barrier Reef region.

Descriptions of Species.

Dictyocha fibula var. *stapedia* (Haeckel), Lemmermann. Text-fig. 5.

Gemeinhardt, 1930, p. 53, fig. 42.

Occurrence.—Found occasionally throughout the year, but only in small numbers. The highest numbers were obtained on 26th January near Low Isles (3 in 100 c.c.). Within the Great Barrier Reef they were distributed more or less evenly from the surface down to 28 metres (the greatest depth sampled), and at stations outside it the few specimens present were not taken below 20 metres.

Distribution.—The Atlantic, Indian and Pacific Oceans.

Remarks.—In this variety the basal ring is a rhomboid, and one pair of spines is slightly longer then the other. The central arch lies parallel to the longer axis.

Dimensions.—Total length as measured from spine tip to spine tip on the longer axis 39–52μ ; length of side 18–24μ ; length of spines 8–11μ and 7–9μ.

Dictyocha fibula var. *hexagona*, n. var. Text-fig. 6.

Gemeinhardt, 1931, p. 233, pl. xlii, fig. 15.

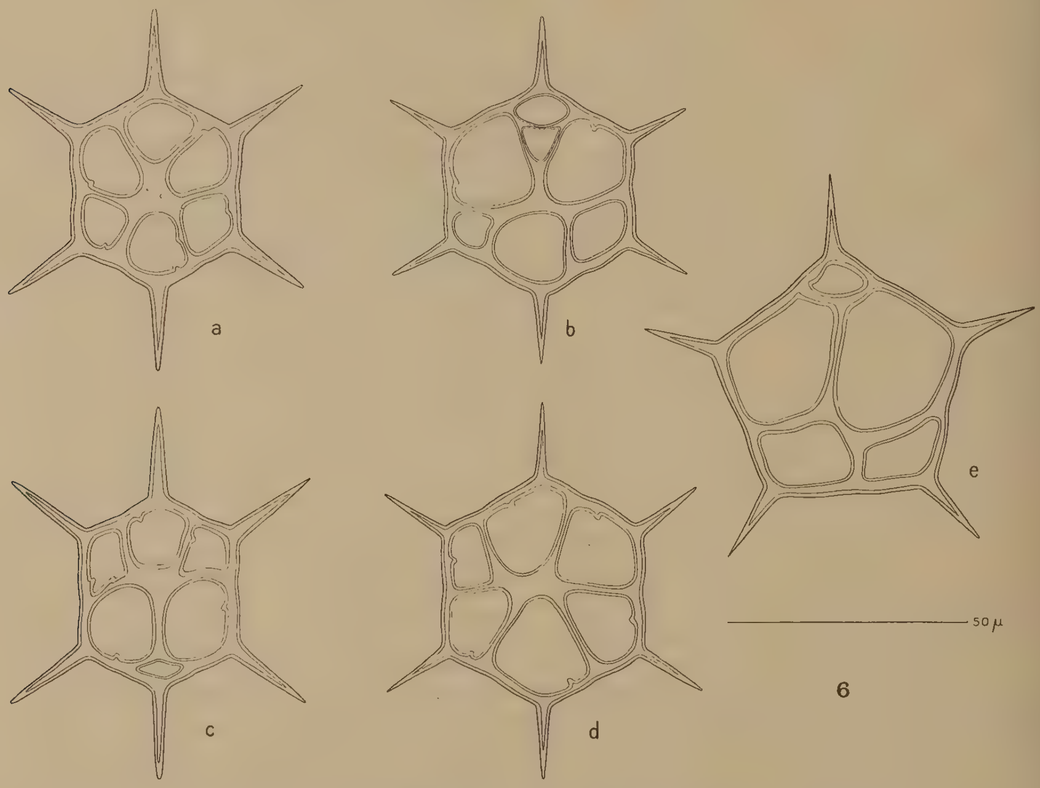
Occurrence.—Appeared only rarely throughout the year.

Distribution.—The Great Barrier Reef region.

Description.—This variety possesses no apical ring, and appears to be in some respects transitional between *Dictyocha* and *Distephanus*. It has a six-sided basal ring.

The supporting bars from adjacent sides fuse and the three resulting bars unite to form a roughly triangular area. Text-fig. 6*a* shows the usual form but there is a good deal of variation, and Text-figs. 6*b–e* show several specimens. Small spines are present on the basal ring in the usual position, and are not infrequent on the supporting bars. The five-sided form (Text-fig. 6*e*) was seen only twice.

Remarks.—This is a difficult form to place. Since it possesses no apical ring it must belong to the genus *Dictyocha*, but it has obvious affinities to *Distephanus speculum* forma *pseudo-fibula*, Schulz. Gemeinhardt (1931) found a single specimen in the material of the German South Polar Expedition, and figured it as an abnormal *Distephanus speculum*, suggesting, however, that it might be a transitional form between *Mesocena polymorpha* var. *hexagona* and *Dictyocha*. Since it appears with fair regularity in the Great Barrier Reef material, it may be classed as an independent variety. A six-sided *Dictyocha*, *D. hexacantha*, Schulz, is already known (as a fossil only), but differs from this in having only three supporting bars, rising opposite the bases of alternate radial spines.



Text-fig. 6.—*Dictyocha fibula* var. *hexagona*, n. var., showing variations in the skeleton. From the Great Barrier Reef region.

The five-sided form (Text-fig. 6*e*) corresponds to *Dictyocha fibula* var. *pentagona*.

Dimensions.—Diameter of basal ring 39–47μ ; diameter from spine-tip to spine-tip, 72–86μ ; length of one side 24–26μ ; length of radial spines 13–17μ.

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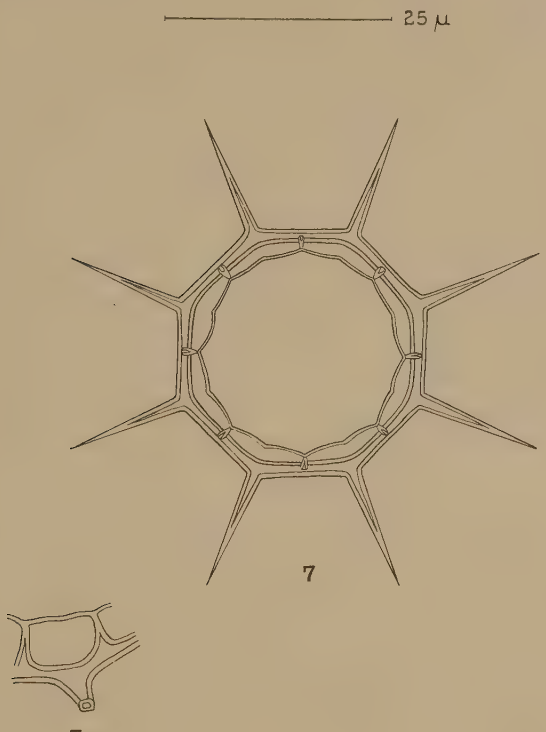
Distephanus speculum var. *bioctonarius* (Ehrenberg). Text-fig. 7.

Mesocena polymorpha var. *bioctonaria*, Gemeinhardt, 1930, p. 32, fig. 17.
Distephanus speculum var. *octonarius*, Gemeinhardt, 1930, p. 69, figs. 59*b*, 60.

Occurrence.—Appeared occasionally throughout the year in small numbers. In water samples they were never more abundant than one in 100 c.c. The station at which most were obtained was H 28 on 19th November, outside Trinity Opening, where they were not taken deeper than 50 m.



Text-fig. 7.—*Distephanus speculum* var. *bioctonarius.* 7*a*. Detail of skeleton. From the Great Barrier Reef region.

Distribution.—The North Sea, the Atlantic, Pacific and Antarctic Oceans; widely distributed as a fossil.

Remarks.—The distinguishing feature of this variety, apart from its octagonal form, is the extreme delicacy of the apical ring. This has a diameter almost as great as that of the basal ring, and is solid, not hollow like the rest of the skeleton. The cavity extends only about half-way up the supporting bars (Text-fig. 7*a*). The apical ring does not always form a double arch between each pair of bars as is shown in Text-fig. 7. The radial spines are square in cross-section (Text-fig. 7*a*). Small spines were occasionally present on the apical ring, but none were observed on the basal ring. One specimen was seen with nine-sided basal and apical rings.

This variety was first found as a fossil (Ehrenberg, 1845, p. 78), and, since it lacked the apical ring either partly or wholly, was described as *Mesocena bioctonaria.* The form possessing both basal and apical rings was put by Gemeinhardt in *Distephanus speculum* var. *octonarius* (Ehrenberg), Jörgensen. This variety *octonarius* does not, however, differ at all from the typical form except in having eight sides, and it seems to me better to keep Ehrenberg's name for the forms with a solid, delicate, apical ring. The number of sides is an exceedingly variable character throughout the family, and individual abnormalities seem to be frequent; forms with a solid apical ring, on the other hand, have not been described except in *Distephanus speculum.* They may occur with seven (Gemeinhardt, 1930), eight or nine sides. The variety is well marked and occurs regularly in the plankton (Gemeinhardt, 1931, Schulz, 1928, and present records).

Dimensions.—Diameter of basal ring 28–30μ ; diameter of apical ring about 23μ ; length of radial spines varying from one specimen to another, 4–13μ.

THE TINTINNOINEA.

Introduction.

The Tintinnids described below are those captured in tow-nettings taken with the International fine silk net described by Russell and Colman (1931, Vol. II, No. 2). The majority of the catches were taken at the weekly station, but two were from stations in the main channel further to the north (Cape Bedford and Lizard Island), and three in passages through the outer barrier (Trinity Opening and Papuan Pass). For the positions of these stations reference should be made to the charts in Vol. II, No. 1 (Russell and Orr, 1931). Work was carried on from July, 1928, till July, 1929, and the results therefore apply to a complete year.

Kofoid and Campbell have recently published (1929) a conspectus of the order Tintinnoinea, in which they review the entire group and the literature concerning it. I am greatly indebted to this work and have throughout followed their classification, which is based entirely on the lorica. Recent work by Hofker (1931) indicates that a study of the lorica alone is not sufficient for a final classification, since there is much variation in shape and structure, and that a number of Kofoid and Campbell's species are in reality only variant forms. At present, however, the lorica is in many cases the only part of the animal available for identification, and descriptions must be based on it.

Fifty-six species occur, of which three are new.

I am greatly indebted to Miss Brown Kelly for the drawings which illustrate this report, with the exception of Text-figs. 8–11.

List of Species.

Tintinnididae.
**Leprotintinnus nordqvisti* (Brandt).

Codonellidae.
Tintinnopsis compressa, Daday.
**T. mortensenii*, Schmidt.
†*T. rotundata*, Jörgensen.
‡*T. gracilis*, Kofoid and Campbell.
T. radix (Imhof).
T. cylindrica, Daday.
†*T. tocantinensis*, Kofoid and Campbell.

Codonellopsidae.
Stenosemella nivalis (Meunier), Kofoid and Campbell.
**Codonellopsis ostenfeldii* (Schmidt).
**C. indica*, Kofoid and Campbell.
§*C. parvicollis*, n. sp.
‡*C. brevicaudata*, Brandt.

Coxliellidae.
Climacocylis scalaria (Brandt), Jörgensen.
||*C. scalaroides*, Kofoid and Campbell.
**Coxliella laciniosa* (Brandt).

Cyttarocylidae.
Favella azorica (Cleve), Jörgensen.

Ptychocylidae.
‡*Epiplocylis ralumensis* (Brandt).
‖*E. healdi*, Kofoid and Campbell.
‡*E. constricta*, Kofoid and Campbell.
‖*E. exigua*, Kofoid and Campbell.
E. blanda (Jörgensen), Kofoid and Campbell.
E. undella (Ostenfeld and Schmidt).
‡*E. deflexa*, Kofoid and Campbell.

Petalotrichidae.
§*Craterella aperta*, n. sp.
‖*Metacylis corbula*, Kofoid and Campbell.

Rhabdonellidae.
Protorhabdonella simplex (Cleve), Jörgensen.
P. curta (Cleve), Jörgensen.
Rhabdonella spiralis (Fol), Brandt.
R. brandti, Kofoid and Campbell.
‖*R. quantula*, Kofoid and Campbell.
R. amor (Cleve), Brandt.
‖*Rhabdonellopsis intermedia*, Kofoid and Campbell.

Xystonellidae.
Xystonella lanceolata (Brandt), Brandt.
X. treforti (Daday), Laackmann.

Undellidae.
**Undella hemispherica*, Laackmann.
‖*U. turgida*, Kofoid and Campbell.
**Proplectella tenuis*, Kofoid and Campbell.
‖*P. perpusilla*, Kofoid and Campbell.
†*P. acuta* (Jörgensen).

Dictyocystidae.
Dictyocysta reticulata, Kofoid and Campbell.

Tintinnidae.
Amphorella quadrilineata (Claparède and Lachmann), Daday.
A. brandti, Jörgensen.
†*A. laackmanni* Jörgensen.
†*A. minor*, Jörgensen.
Steenstrupiella steenstrupii (Claparède and Lachmann).
†*S. intumescens*, Jörgensen.
**Amphorellopsis acuta* (Schmidt).
Dadayiella ganymedes (Entz Sr.), Kofoid and Campbell.
Tintinnus attenuatus, Kofoid and Campbell.
T. lusus-undae, Entz Sr.
‖*T. stramentus*, Kofoid and Campbell.
‖*T. pacificus*, Kofoid and Campbell.
T. apertus, Kofoid and Campbell.
§*Daturella luanae*, n. sp.
‖*Salpingella subconica*, Kofoid and Campbell.

Distribution.

Among the Tintinnids obtained by the Expedition two groups can be distinguished: firstly, those adapted to neritic conditions, and secondly, those which are oceanic in habitat and are restricted to water of relatively high salinity. Members of the first group are found throughout the year and are often especially common in March. They include most species of the genera *Leprotintinnus*, *Tintinnopsis* and *Codonellopsis*, and *Epiplocylis healdi*, *Rhabdonella spiralis*, *R. brandti* and *R. amor*. Members of the second group are rarer, and occur mainly at the weekly station in August and September (when the salinity inside the Barrier was over $35\,^{\circ}/_{\circ\circ}$), and at stations on or near the outer reefs. Such species are *Climacocylis scalaria*, *Epiplocylis* spp. (apart from *E. healdi*), *Rhabdonella quantula*, *Rhabdonellopsis intermedia*, *Xystonella* spp., *Undella* spp., and *Daturella luanae*. The remainder are either too rare to give an accurate indication of their habitat, or do not conform strictly to either group, although a number were more common at outside stations (*e.g. Proplectella* spp. and *Climacocylis scalaroides*).

Of the fifty-six species listed, twenty-two (unmarked in the above list) are cosmopolitan and have been recorded from the Atlantic, Pacific and Indian Oceans, sometimes from temperate and even arctic regions. Nine species (marked with *), are restricted to warm seas, although they may be widely distributed within the tropics. Of the numerous new species found by Kofoid and Campbell from the Agassiz Expedition to the eastern tropical Pacific, eleven (marked with ‖) can now be recorded from the western Pacific also. Five (marked with ‡) have hitherto been recorded by Brandt from the western Pacific (of which two have also been found by Kofoid and Campbell in the eastern Pacific).

The records of six species (marked with †) are so scattered that their distribution cannot be ascertained at all accurately. The remaining three species (marked with §) are new.

Table I shows the occurrence of the species throughout the year at the stations examined, and for this records from water samples have been used, where available, as well as those from tow-nettings. It will be seen that catches from outside stations are usually rich in species, although they lack the neritic forms. One of the richest catches (for numbers of species) was that from Lizard Island on 27th February. This is partly because, being near the outer reefs, oceanic as well as neritic species are represented, and partly because diatoms were abundant. These tend to block the meshes of the net, so that small species which would otherwise be lost are retained. The richest catch of all (containing forty-three species) was obtained, however, at the weekly station on 4th March. Twenty-one out of the fifty-six species are present throughout the year, and may be considered as characteristic of the fauna of the Great Barrier Reef lagoon.

The results from stations on or near the outer reefs suggest that there is a rich tintinnid fauna in the ocean waters outside, of which only some species can live permanently within the Barrier.

In the following descriptions reference is made only to the earliest description of the species and to Kofoid and Campbell's monograph, where a full list of synonyms will be found.

DESCRIPTIONS OF SPECIES.

Leprotintinnus nordqvisti (Brandt).

Tintinnopsis nordqvisti, Brandt, 1906, pp. 4, 18; pl. xxiv, figs. 1–4; 1907, pp. 166–167.
Leprotintinnus nordqvisti, Kofoid and Campbell, 1929, p. 17, fig. 13.

OCCURRENCE.—This species was present throughout the year and was abundant in November and March. It was not taken outside the Great Barrier Reef.

DISTRIBUTION.—The N. coast of South America and the mouth of the Amazon; Siam, Malay Archipelago, and west coast of Borneo.

REMARKS.—The lorica decreases slightly in width towards the aboral end and then flares out to the aboral opening, which is wider (58–123μ) than in the specimens described hitherto (mouth of the Amazon 50–60μ; coast of Borneo 40–52μ). There is sometimes an indication of a spiral structure in the arrangement of agglomerated material on the tube, but this is never clear.

DIMENSIONS.—Length 125–254μ; diameter at mouth 34–44μ; diameter at aboral end 58–123μ; diameter just above aboral flare 30–34μ.

Tintinnopsis compressa, Daday. Text-fig. 8.

Tintinnopsis beroidea var. *compressa,* Daday, 1887, p. 548, pl. xix, figs. 7–9, 28. *T. nucula,* Daday, *ibid.,* p. 554, pl. xix, figs. 30, 31.
Tintinnopsis compressa, Kofoid and Campbell, 1929, p. 32, fig. 71.

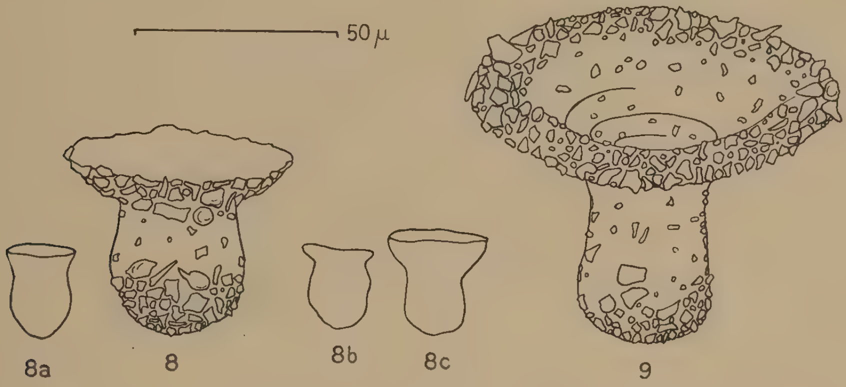
OCCURRENCE.—Occasional throughout the year and common in March.

DISTRIBUTION.—The Mediterranean; the Red Sea; Woods Hole, Massachusetts.

REMARKS.—Kofoid and Campbell have united Daday's *T. beroidea* var. *compressa* and his *T. nucula* to form this species, which has also been described from the Mediterranean by Jörgensen (1924).

The present specimens are variable in form. Some of them agree well with the figures of Daday and Jörgensen, but the majority have a more marked suboral constriction and a more spreading brim. Text-fig. 8 shows what is perhaps the most common form. Text-figs. 8*a*, 8*b*, 8*c* are sketches (on a smaller scale) of other varieties, of which 8*a* resembles Daday's form most closely.

Dimensions.—Length 39–59μ ; diameter at mouth 34–65μ ; greatest diameter of bowl 28–34μ.



Text-figs. 8, 9.—8, 8*a*, 8*b*, 8*c*. *Tintinnopsis compressa.* 9. *T. mortensenii.*

Tintinnopsis mortensenii, Schmidt. Text-fig. 9.

Tintinnopsis mortensenii, Schmidt, 1902, p. 186, fig. 3 ; Kofoid and Campbell, 1929, p. 40, fig. 61.

Occurrence.—Common in November and March, otherwise occasional.

Distribution.—The Gulf of Siam ; the mouth of the Tocantins.

Remarks.—The marked feature of this species is the wide spreading brim. In the specimens from Siam (Schmidt) the diameter of the brim was 53μ, in those from the mouth of the Tocantins (Brandt, 1907, p. 152) 85μ, and in those from the Great Barrier Reef material it varies from 67 to 108μ. In length the Great Barrier Reef specimens are intermediate between those of Brandt and Schmidt. The species also resembles *T. bütschli* Daday, but is considerably smaller, and has a wider brim in proportion to the length. The agglomerated material is thinly scattered on the proximal part of the brim, but is very thick at the edge. A spiral structure can usually be made out in the throat.

Dimensions.—Total length 60–70μ ; greatest width of bowl 29–38μ ; width of brim 67–108μ.

Tintinnopsis rotundata, Jörgensen.

Tintinnopsis beroidea, Daday, 1887, p. 547, pl. xix, figs. 2, 14.
Tintinnopsis rotundata, Kofoid and Campbell, 1929, p. 46, fig. 73.

Occurrence.—Present during most of the year and common in March.

Distribution.—At Wismer in the Baltic ; the Gulf of Naples.

Remarks.—This is a very regular form and varies little in dimensions. It also resembles closely *T. tenuis* Hada, 1932, from which it differs only in the lack of spiral marking.

Dimensions.—Length 52–57μ ; width 26–28μ.

Tintinnopsis gracilis, Kofoid and Campbell.

Tintinnopsis karajacensis var. a, Brandt, 1906, p. 16, pl. xix, figs. 1, 2, 21 ; 1907, p. 163.
Tintinnopsis gracilis, Kofoid and Campbell, 1929, p. 36, fig. 37.

Occurrence.—Present throughout the year and was abundant in November and March.

Distribution.—The west coast of Borneo.

Remarks.—This form agrees exactly with that figured by Brandt (1906, pl. xix, fig. 2). It is almost cylindrical, widening slightly from the mouth to the lower third and then narrowing to a bluntly conical point.

Dimensions.—Length 123–177μ ; diameter at mouth 34–38μ ; greatest diameter 38–44μ.

Tintinnopsis radix (Imhof). Text-fig. 10.

Codonella radix, Imhof, 1886, p. 103.
Tintinnopsis radix, Kofoid and Campbell, 1929, p. 45, fig. 93.

Occurrence.—Present throughout the year at the weekly station and sometimes abundant (November, March).

Distribution.—A neritic species with a wide distribution along the coasts of the Mediterranean and the Atlantic, Indian and Pacific Oceans.

Remarks.—This species is certainly the *T. fracta* of Brandt (1906, p. 4, pl. xxiii, figs. 1, 3–5, 9–13 ; pl. xxxi, fig. 8 ; 1907, pp. 174–176). He separated it from similar forms (notably *T. curvicauda*, Daday) on account of the opening at the posterior end, which is now generally considered to be an artefact, possibly caused by fixation (Jörgensen, 1924). The opening is always in the same position, on one side of the pedicel ; it extends to the foot and often has a very regular edge ; moreover Brandt says that it was present in every tropical specimen he examined, and this is also true of the Great Barrier Reef material. It is possible that the animal is attached at this point, and that it tears a hole there in leaving its case, or at death by fixation. Further observations on living material are needed to clear up this point, and until this is done it is perhaps better to unite forms which are alike (as Kofoid and Campbell have done), whether they are open at the tip or not. The present material was fixed in formalin, so the break is not caused, as Jörgensen suggests, by alcohol fixation only.

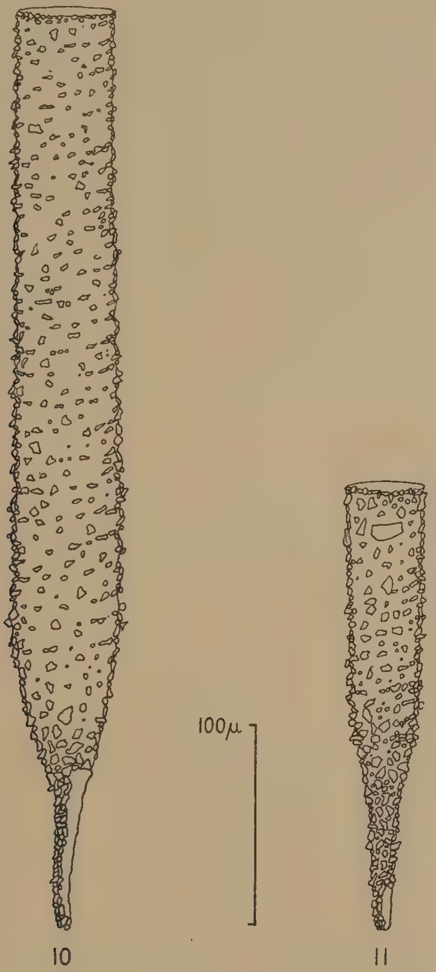
The length, if we consider those from other localities also, is very variable, and in this case (unlike the Tintinnidae) the oral diameter is variable as well. The sizes of the present specimens agree most closely with those of Brandt from the west coast of Borneo (1907, p. 175). The lorica is almost cylindrical for about two-thirds of its length ; it often gets slightly wider towards the bowl, and rarely slightly narrower. In the basal third it narrows to a slender and slightly curved pedicel. A spiral structure is clearly visible from the mouth down to the narrowing. The pedicel and the part close to the mouth are thickly covered with agglomerated particles, but on the rest of the lorica they are scarcer.

Dimensions.—Length 353–502μ ; diameter at mouth 46–61μ ; length of pedicel (measured from where lorica begins to narrow) 116–172μ ; 24–30 spiral turns on the cylindrical part of bowl.

Tintinnopsis cylindrica, Daday. Text-fig. 11.

Tintinnopsis Davidoffii var. *cylindrica*, Daday, 1887, partim, p. 553, pl. xix, fig. 24.
Tintinnopsis cylindrica, Kofoid and Campbell, 1929; p. 33, fig. 96.

Occurrence.—Present throughout the year at the weekly station and sometimes abundant (November and March).



Text-figs. 10, 11.—10. *Tintinnopsis radix*. 11. *T. cylindrica*.

Distribution.—The Mediterranean, the Baltic, the western Pacific.

Remarks.—In two respects this form differs from the type. It often shows a rather indistinct spiral marking, and the tip of the pedicel is open. In this and other respects it resembles *T. radix*. It is smaller than the Great Barrier Reef *T. radix* (although a few specimens of intermediate size are found), but is about the same size as *T. radix* from other localities (*e.g.* Brandt's *T. fracta* from New Pomerania, Zanzibar and S.W. Africa). The pedicel is wider and usually nearly half as long as the whole lorica; it is very frequently broken off short; the diameter is less and the lorica invariably gets slightly narrower towards the pedicel; it is more thickly encrusted with agglomerated material; a spiral structure is often visible, especially towards the pedicel, but it is much less distinct than in *T. radix*. Hada's *T. kofoidi* (1932*a*) resembles this form, but lacks the spiral marking and has straighter sides.

Dimensions.—Length 144–300μ; diameter at mouth 34–45μ (one specimen 50μ); length of pedicel 62–120μ; 8–13 spiral turns on bowl.

Tintinnopsis tocantinensis, Kofoid and Campbell.

Tintinnopsis aperta var. a, Brandt, 1906, p. 19, pl. xxv, figs. 2, 7; 1907, p. 177.
Tintinnopsis tocantinensis, Kofoid and Campbell, 1929, p. 48, fig. 46.

Occurrence.—Very rare. It appeared at a few of the weekly stations in March and April, and off Lizard Island in February.

Distribution.—Off the mouth of the Tocantins River, and in Mutsu Bay, Japan.

Remarks.—This form agrees very closely with Brandt's figure and, like his, is open at the aboral end. In one specimen there was a faint suggestion of spiral marking just below the mouth.

Dimensions.—Length 65–92μ; diameter at mouth 17–19μ; greatest diameter of bowl 22–28μ.

Stenosemella nivalis (Meunier), Kofoid and Campbell.

Codonella ventricosa, Entz Sr., 1884, p. 413, pl. xxiv, fig. 24.
Stenosemella nivalis, Kofoid and Campbell, 1929, p. 69, fig. 136.

Occurrence.—Very rare. In February off Lizard Island, and in October and March at the weekly station.

Distribution.—The Mediterranean and the coast of Europe generally; Mutsu Bay, in Japan.

Remarks.—This is a very small form and seems to vary considerably in shape. The collar contracts a little towards the mouth and is often scarcely emergent. The lorica is usually widest shortly below the collar, and has a broadly rounded aboral end. A good figure is given by Hada, 1932, Text-fig. 11.

Dimensions.—Total length 31–34μ; diameter at mouth 16–19μ; greatest diameter 30μ; height of collar up to 6μ.

Codonellopsis ostenfeldii (Schmidt).

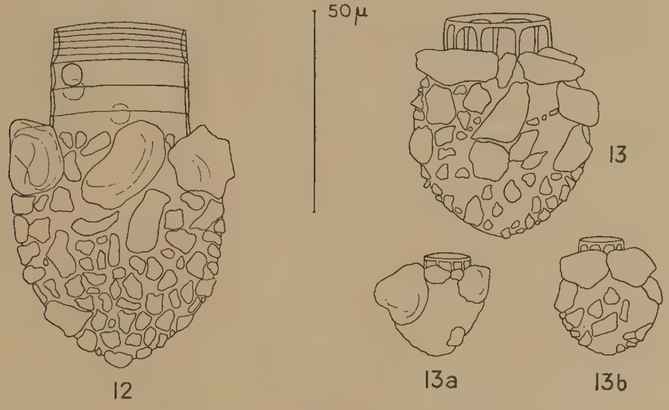
Codonella ostenfeldii, Schmidt, 1902, p. 187, fig. 4.
Codonellopsis ostenfeldi, Kofoid and Campbell, 1929, p. 84, fig. 160.

Occurrence.—Common all year, abundant in August, November and March. One of the commonest tintinnids in these waters.

Distribution.—The Red Sea and Arabian Sea; the Indian Ocean; the Malay Archipelago; off Zanzibar; the Gulf of Siam; off the coast of Borneo.

Remarks.—This species is distinguished by a long collar, built up of a fenestrated spiral lamina whose edge can be seen as a line between the rows of fenestrae. The bowl is ovate often with projecting shoulders where the collar and bowl join, and is covered with agglomerated particles, often large. The collar is slightly everted at the oral end, and sometimes, especially when it is long, narrows slightly where it meets the bowl. The number of turns in the spiral lamina varies greatly, every number from 3 to 15 being counted from a single tow-netting (Station 51). Brandt records the number of turns as 3–6, usually 4 or 5, but sometimes 9–12. Schmidt has recorded specimens from the Gulf of Siam with as many as 18. The top and, less frequently, the bottom turn of the spiral of fenestrae is sometimes incomplete or has fenestrae markedly smaller than the rest. The lamina usually makes several free turns (*i. e.* without fenestrae) just below the mouth. There may be several free turns at the foot of the collar also. Brandt (1907) has pointed out that the fenestrae are not really holes, but that the wall is much thinner there. He has given a good figure of the species (1906, pl. xiv, fig. 2).

Dimensions.—The total length depends almost entirely on the length of the collar, 99μ (3 turns)–189μ (13–15 turns); diameter at mouth 38–42μ. Bowl a little longer than wide, 59–77μ long by 60–65μ wide.



Text-figs. 12, 13.—12. *Codonellopsis indica.* 13, 13*a*, 13*b*. *C. parvicollis.*

Codonellopsis indica, Kofoid and Campbell. Text-fig. 12.

Codonella morchella partim, Brandt, 1906, p. 15, pl. xiii, fig. 3; pl. xiv, fig. 3; 1907, p. 124.
Codonellopsis indica, Kofoid and Campbell, 1929, p. 80, fig. 158.

Occurrence.—Present throughout the year, but was never as common as *C. ostenfeldii*.

Distribution.—Off Zanzibar; off Borneo.

Remarks.—This species differs from the last in the much smaller number and irregular arrangement of fenestrae on the collar. The agglomerated particles are often very large, especially on the shoulders, as is shown in Brandt's second figure (pl. xiv, fig. 3). This species seems to differ very little from *C. americana*, Kofoid and Campbell, and *C. orientalis*, Hada (1932), the distinguishing characters being only slight differences in the shape of the bowl, which, in the Great Barrier Reef material, is rather variable.

C. americana is described as having a more rotund bowl, and *C. orientalis* a more pointed aboral end.

Dimensions.—Total length 73–94μ; length of collar 21–39μ; diameter at mouth 30–36μ; dimensions of bowl 47–60μ long by 44–54μ wide; 6–12 spiral turns on the collar with 1–3 scattered fenestrae.

Codonellopsis parvicollis, n. sp. Text-fig. 13.

Occurrence.—Appeared throughout the year.

Distribution.—The Great Barrier Reef region.

Description.—The total length is a little more than twice the oral diameter. The bowl is ovate, a little longer than wide, and is thickly covered with agglomerated particles, frequently of large size and irregular shape. These agglomerations are often particularly large on the shoulders just below the collar, as is shown in Text-figs. 13*a* and 13*b*.

The collar is short and has only one row of fenestrae, usually 6 or 7 in number. They are irregular in shape, and are usually rectangular rather than circular or oval. In only one specimen one or two irregular fenestrae were seen below the usual single circle.

The species is a little reminiscent of Daday's (1886) *Dictyocysta ovalis*, but the shape of the collar is different, and the present species has never been seen with coccoliths. It differs from the other species of the genus in the short collar.

Dimensions.—Total length 48–61μ ; dimensions of bowl 43–56μ long by 39–51μ wide ; height of collar 5–9μ (13 in the specimen with a double row of fenestrae) ; diameter at mouth 22–29μ.

Codonellopsis brevicaudata (Brandt).

Codonella brevicaudata, Brandt, 1906, pp. 3, 14, pl. iv, fig. 19, pl. xi, fig. 7 ; pl. xii, figs. 2 and 2*a* ; 1907, p. 118.

Codonellopsis brevicaudata, Kofoid and Campbell, 1929, p. 77, fig. 178.

Occurrence.—Seen only in the catch from off Lizard Island, in February.

Distribution.—Pacific Ocean, near New Pomerania.

Remarks.—The single specimen seen agreed in all respects with those described and figured by Brandt.

Dimensions.—Total length 178μ ; length of collar 101μ ; diameter at mouth 53μ ; dimensions of bowl 77μ long by 60μ wide ; 20 spiral turns on collar.

Climacocylis scalaria (Brandt), Jörgensen.

Cyttarocylis (Coxliella) scalarius, Brandt, 1906, pl. xxi, fig. 15 ; pl. xxvi, figs. 4–6 ; pl. xxvii, figs. 2, 3 ; 1907, pp. 264–267.

Climacocylis scalaria, Kofoid and Campbell, 1929, p. 93, fig. 185.

Occurrence.—In Papuan Pass in February.

Distribution.—Widely distributed in the Atlantic ; also obtained off Madagascar and in the Pacific.

Remarks.—The lorica of the genus *Climacocylis* is very inconspicuous and may easily be overlooked. It consists of a cylindrical tube, open at the aboral end, which is expanded into a large irregular mass or frill. A spiral band is visible on the cylindrical part, and this band bears a projecting ridge or shelf. The shelf becomes wider towards the aboral end. The secondary structure is well marked and consists of large irregularly hexagonal meshes, but the lorica as a whole is extraordinarily delicate and transparent.

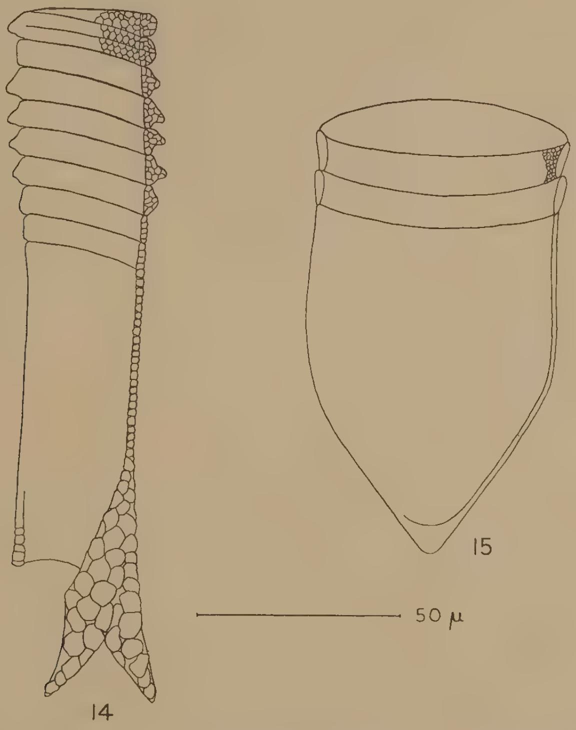
Dimensions.—Length, excluding frill, 181–258μ ; length of frill 65–86μ ; diameter at mouth 47–52μ ; number of spiral turns 4–13.

Climacocylis scalaroides, Kofoid and Campbell. Text-fig. **14.**

Cyttarocylis scalarius var. a, Brandt, 1907, pp. 266–267.
Climacocylis scalaroides, Kofoid and Campbell, 1929, pp. 93, fig. 187.

Occurrence.—At Trinity Opening in August and November; in Papuan Pass in February; and at the weekly station occasionally during the year.

Distribution.—The Pacific, in the California Current, North Equatorial Current, Panamic area and South Equatorial Current; south-west of Australia; Bay of Biscay and Mediterranean; off Madagascar; the junction of the Labrador and Florida Currents.



Text-figs. 14, 15.—14. *Climacocylis scalaroides*. 15. *Favella azorica*.

Remarks.—The lorica of this species also is very delicate and transparent. It is narrower and usually smaller than the preceding species. The spiral band is restricted to the upper part and may show from five to ten turns. Of these the lowest one or two are usually flat, but the rest are produced into a rounded ridge. The lorica may be cylindrical or may narrow a little towards the aboral end, but this is partially closed by a great thickening in the wall. There are almost always one or, more frequently, two triangular prolongations from one side of the aboral end. The secondary structure is similar to that of the preceding species and the meshes become very large in the caudal prolongations. The species as described by Kofoid and Campbell does not have these caudal flaps, but they are not invariably present and the form otherwise agrees very well.

Dimensions.—Length 90–224μ ; diameter at mouth 30–37μ ; number of spiral turns 4–17. One specimen was found measuring 271μ in length and 56μ in oral diameter. It had no caudal prolongation. In structure (apart from the aboral end) it resembled *C. scalaroides*, but in dimensions was nearer to *C. scalaria*.

Coxliella laciniosa (Brandt).

Cyttarocylis ? (Coxliella) ampla (?) var. a, *laciniosa*, Brandt, 1906, p. 20, pl. xxviii, figs. 1, 2, 4 ; pl. xxix, fig. 3 ; *Cyttarocylis ? (Coxliella) laciniosa*, 1907, p. 270.
Coxliella laciniosa, Kofoid and Campbell, 1929, p. 100, fig. 193.

Occurrence.—Very rare. Found singly in Papuan Pass, and in March at the weekly station.

Distribution.—Widely distributed in the warm regions of the Atlantic ; the Mediterranean ; the Indian Ocean (off Madagascar) and the western Pacific (New Pomerania).

Remarks.—The two specimens observed are slightly wider towards the foot of the bowl than at the mouth, and end in a short blunt pedicel. The wall is thick at the mouth and thins out aborally but, unlike Brandt's specimens, is built up with only one layer of primary structure meshes. The primary meshes are small near the mouth, increase in size in the second and remain large in the third, fourth and fifth turn from the mouth. After this they decrease. There are numerous oval fenestrae between the sixth and seventh spiral turns.

Dimensions.—Length 93 and 95μ ; diameter at mouth 60 and 58μ ; greatest width 64μ ; wall about 3μ thick near mouth ; 8 spiral turns.

Favella azorica (Cleve), Jörgensen. Text-fig. 15.

Undella azorica, Cleve, 1900, p. 974, fig. (10).
Favella azorica, Kofoid and Campbell, 1929, p. 151, fig. 284.

Occurrence.—Rare. Appeared occasionally throughout the year.

Distribution.—The Azores ; the Mediterranean ; the Persian Gulf ; the Gulf of Siam ; the Fukien Strait.

Remarks.—The lorica is campanulate and is nearly twice as long as broad. It is almost cylindrical in the upper half to two-thirds and then tapers to a blunt, solid point. There are usually one or two annuli present at the oral end, but these may be absent. The two lamellae of the wall are not distinct, as in Jörgensen's specimens.

Kofoid and Campbell suggest that this may be a *Proplectella* sp., but the secondary structure is that typical of *Favella*, and there seems no reason to doubt Jörgensen's classification. Cleve's original figure shows no annuli, but these are not always present and the shape and size agree well. *F. composita* (Jörgensen) is similar in shape and the possession of annuli, but these are numerous and very narrow.

Dimensions.—Length 73–107μ ; diameter at mouth 47–65μ ; number of annuli none, 1 or 2.

Epiplocylis ralumensis (Brandt).

Ptychocylis reticulata var. *ralumensis*, Brandt, 1906, pp. 28, 29 ; pl. lviii, figs. 3, 8 ; 1907, p. 289.
Epiplocylis ralumensis, Kofoid and Campbell, 1929, p. 184, fig. 320.

Occurrence.—Very rare. One specimen from the station off Lizard Island, and one in March from the weekly station.

DISTRIBUTION.—The western tropical Pacific.

REMARKS.—The two specimens seen were a little shorter than Brandt's, but otherwise resembled his figure closely.

DIMENSIONS.—Length 69–73μ ; diameter at mouth 47–49μ and (including collar) 57μ.

Epiplocylis healdi, Kofoid and Campbell. Text-fig. 16.

Epiplocylis healdi, Kofoid and Campbell, 1929, p. 180, fig. 321.

OCCURRENCE.—Present throughout the year.

DISTRIBUTION.—The Peruvian Current, Mexican Current, Panamic area, South Equatorial Drift and Galapagos Eddy.

REMARKS.—This is the most abundant species of the genus in the Great Barrier Reef material. It is rather variable in form (perhaps because the lorica is thin and easily distorted) and also in its secondary structure. The mouth is double with an erect inner and a spreading outer collar. In most cases there are reticulations on the lower third of the bowl, and from these a number of vertical anastomosing striæ, about 10–17 across one face, run to, or almost to, the collar. The anastomoses vary, however, and are sometimes so frequent that the whole bowl appears to be reticulated, in which case the structure resembles that of *E. reticulata* (Ostenfeld and Schmidt), Jörgensen. Intermediate cases are also seen. At the lip of the collar the primary structure is coarse and consists of large meshes, but it rapidly becomes very fine. Two varieties of shape are shown in Text-figs. 16 and 16*a*.

DIMENSIONS.—Length 65–77μ ; diameter at mouth 43–48μ and (including collar) 52–54μ.

Epiplocylis constricta, Kofoid and Campbell.

Ptychocylis undella var. c, Brandt, 1906, p. 29, pl. lix, fig. 2 ; 1907, p. 295.
Epiplocylis constricta, Kofoid and Campbell, 1929, p. 177, fig. 333.

OCCURRENCE.—Rare. In August, at the weekly station.

DISTRIBUTION.—Off Ralum in the western, and also in the eastern, Pacific.

REMARKS.—The species agrees closely with Brandt's figure. It is not so straight sided as *E. undella*, and the secondary structure is much finer than in *E. deflexa*.

DIMENSIONS.—Length 90–112μ ; diameter at mouth 60μ ; pedicel 15–24μ.

Epiplocylis exigua, Kofoid and Campbell. Text-fig. 17.

Epiplocylis exigua, Kofoid and Campbell, 1929, p. 178, fig. 337.

OCCURRENCE.—Rare. Occurred only in Trinity Opening, a passage through the Great Barrier Reef.

DISTRIBUTION.—The Pacific, in the South Equatorial Drift and the Peruvian Current.

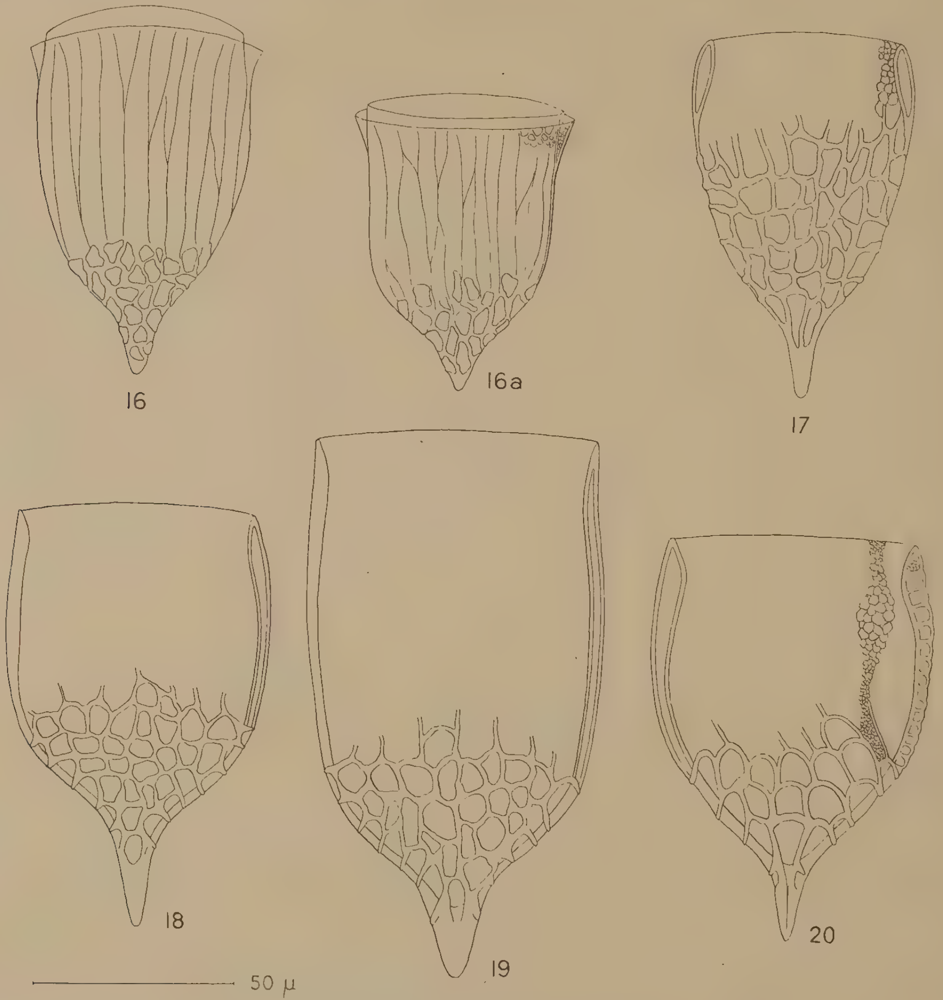
REMARKS.—This rare form resembles both *E. exigua*, Kofoid and Campbell, and *E. labiosa*, Kofoid and Campbell (*Ptychocylis calyx*, var. b, Brandt, 1906, pl. lviii, figs. 13, 13*a*). I have put it in the former species because of the longer and more gradual sub-oral thickening, and because the reticulation is absent on the upper quarter of the bowl (·25–·40 in *E. exigua*, ·20 in *E. labiosa*, according to Kofoid and Campbell).

DIMENSIONS.—Total length 88μ ; diameter at mouth 48μ ; pedicel 22μ.

Epiplocylis blanda (Jörgensen), Kofoid and Campbell. Text-fig. 19.

Epiplocylis undella var. *blanda*, partim, Jörgensen, 1924, p. 54, fig. 62.
Epiplocylis blanda, Kofoid and Campbell, 1929, p. 176, fig. 341.

Occurrence.—In Papuan Pass and off Lizard Island in February; rarely at the weekly station in February and March.



Text-figs. 16–20.—16, 16*a*. *Epiplocylis healdi*. 17. *E. exigua*. 18. *E. undella*. 19. *E. blanda*. 20. *E. deflexa*.

Distribution.—The Mediterranean; the Sargasso Sea.

Remarks.—This species is the largest of the genus *Epiplocylis* in these waters. The lower part of the bowl is covered with strong coarse reticulations, which end in free, vertical ribs. The upper two-thirds is covered with very fine reticulations, which are slightly larger in the middle of the bowl.

Dimensions.—Length 120–155µ; diameter at mouth 65–90µ, usually about 70µ; pedicel 26–32µ.

Epiplocylis undella (Ostenfeld and Schmidt). Text-fig. 18.

Cittarocylis Undella, Ostenfeld and Schmidt, 1902, p. 181, fig. 30.
Epiplocylis undella, Kofoid and Campbell, 1929, p. 185, fig. 345.

Occurrence.—In Papuan Pass and off Lizard Island in February; rare at the weekly station in September and March.

Distribution.—The Mediterranean; the Red Sea; the Atlantic.

Remarks.—This species differs from *E. blanda* only in its smaller size.

Dimensions.—Length 103–112μ; diameter at mouth 56–62μ; length of pedicel 26–30μ.

Epiplocylis deflexa, Kofoid and Campbell. Text-fig. 20.

Ptychocylis undella var. b, Brandt, 1906, p. 29, pl. lix, fig. 3; 1907, p. 295, as var. d.
Epiplocylis deflexa, Kofoid and Campbell, 1929, p. 178, fig. 334.

Occurrence.—In Papuan Pass in February and at the weekly station in March.

Distribution.—New Pomerania and the eastern Pacific.

Remarks.—This is an oceanic form found only rarely inside the Great Barrier Reef. It is smaller and more angular than the two preceding species, and the reticulation over most of the bowl is much coarser. The free ribs are directed to the left. The shape is sometimes less angular than shown.

Dimensions.—Length 95–112μ; diameter at mouth 56–73μ; pedicel 16–24μ.

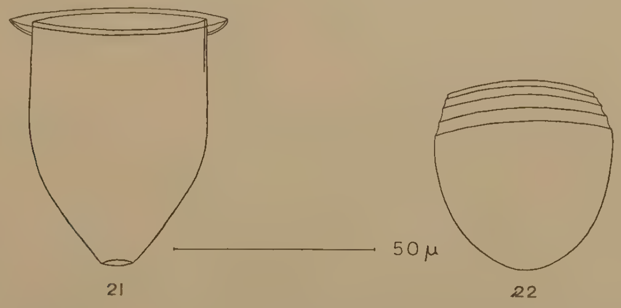
Craterella aperta, n. sp. Text-fig. 21.

Occurrence.—Rare. In January and March at the weekly station, in Papuan Pass and off Lizard Island.

Distribution.—The Great Barrier Reef region.

Description.—The lorica is campanulate, almost cylindrical in the upper third to half, then contracting to an aboral opening. There is a double collar, the outer one flaring and the inner erect. The wall is thin and hyaline. This species differs from all others of the genus *Craterella* in the possession of a wide aboral opening.

Dimensions.—Length 56–65μ; diameter of mouth (inner collar) 43–45μ; diameter of outer collar 52–55μ; aboral opening 7–9μ.



Text-figs. 21, 22.—21. *Craterella aperta*. 22. *Metacylis corbula*.

Metacylis corbula, Kofoid and Campbell. Text-fig. 22.

Metacylis corbula, Kofoid and Campbell, 1929, p. 199, fig. 376.

Occurrence.—Rare. In December and March at the weekly station and off Lizard Island in February.

Distribution.—The Bay of Panama.

Remarks.—The lorica is as wide as long, and is broadly rounded aborally. The collar, on which there are four or five spiral turns, contracts a little towards the mouth.

Dimensions.—Total length 39–43μ ; diameter at mouth 36–38μ ; greatest diameter 42–44μ ; height of collar about 8μ.

Protorhabdonella simplex (Cleve), Jörgensen.

Cyttarocylis simplex, Cleve, 1900, p. 972, fig. (7).
Protorhabdonella simplex, Kofoid and Campbell, 1929, p. 208, fig. 395.

Occurrence.—It was present during most of the year and was common from May to July, but it was scarce or absent from January to April.

Distribution.—The warm regions of the Atlantic ; the coast of Chile ; the Red Sea and Arabian Gulf ; the Gulf of Siam.

Remarks.—One of the commoner species in the Great Barrier Reef material and frequent in water samples. There are about 7–10 vertical ribs, which do not quite reach the mouth, and the slightly flaring oral rim is marked by a spiral line. The specimens are slightly longer than Jörgensen's, measuring 58–69μ in length compared with his 52–58μ.

Dimensions.—Length 58–69μ ; diameter at mouth 32–38μ.

Protorhabdonella curta (Cleve), Jörgensen.

Cyttarocylis striata, forma *β curta*, Cleve, 1901, p. 922, fig. 3*b*.
Protorhabdonella curta, Kofoid and Campbell, 1929, p. 207, fig. 393.

Occurrence.—Rare. In August, September, March and April at the weekly station and off Lizard Island in February.

Distribution.—The Red Sea ; the southern Atlantic ; the Indian Ocean ; the Mediterranean.

Remarks.—This is a smaller species than the last, and has more numerous though less strongly-marked ribs, which often take a spiral course, especially near the mouth. It is of the same general shape as *P. simplex*.

Dimensions.—Length 39–52μ ; diameter at mouth 24–28μ.

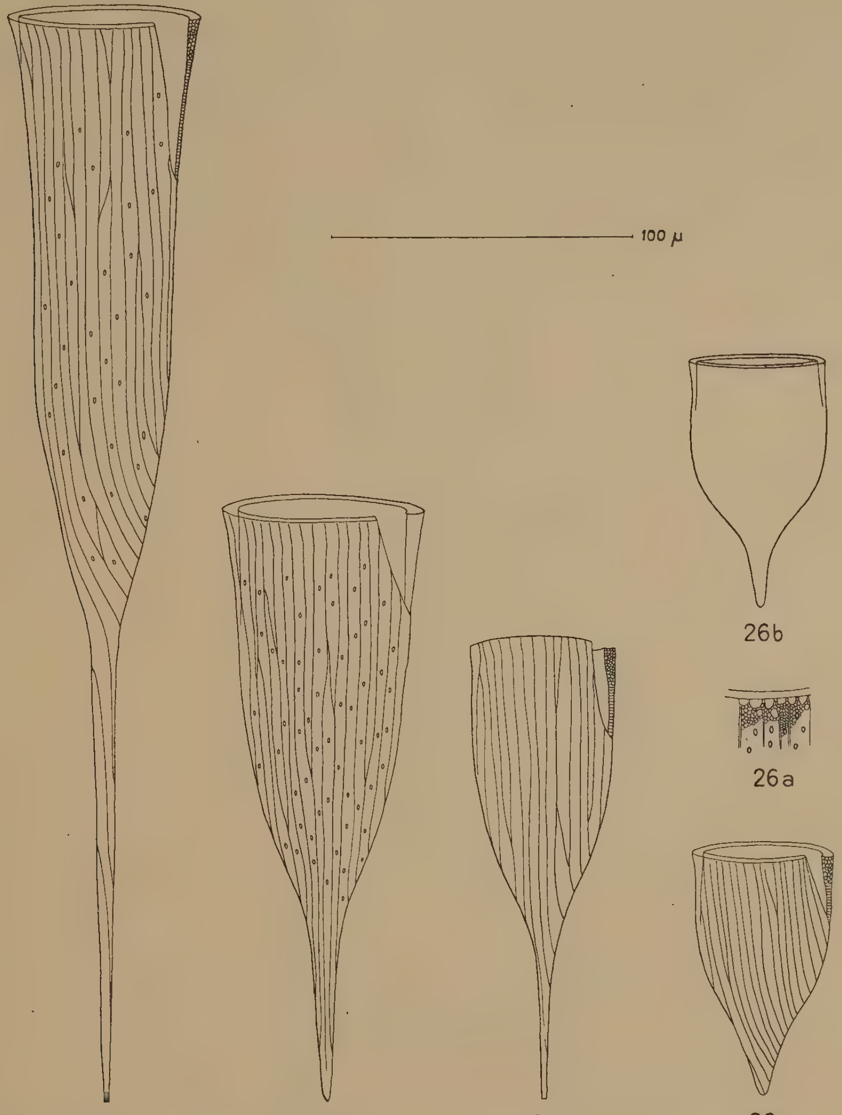
Rhabdonella spiralis (Fol), Brandt. Text-fig. 23.

Ptychocylis (*Rhabdonella*) *spiralis* var. c *indopacifica*, partim, Brandt, 1906, p. 27, pl. liii, figs. 8–10 ;
Rhabdonella spiralis var. c *indopacifica*, Brandt, 1907, p. 326.
Rhabdonella spiralis, Kofoid and Campbell, 1929, p. 219, fig. 414.

Occurrence.—One of the common species in the lagoon of the Great Barrier Reef. It was numerous in July, August and September, and occurred throughout the year, except in December.

Distribution.—Apparently a cosmopolitan species, occurring in the Mediterranean and in the warmer regions of the Atlantic, Indian and Pacific Oceans.

Remarks.—*R. spiralis*, as described by Brandt, was a comprehensive species, containing a number of varieties. It has recently been split up by Kofoid and Campbell into a considerable number of new species, some corresponding partly or entirely to Brandt's varieties. Until their full descriptions are published it is not possible to find out on what differences their species are founded. Jörgensen (1924) considers that there is

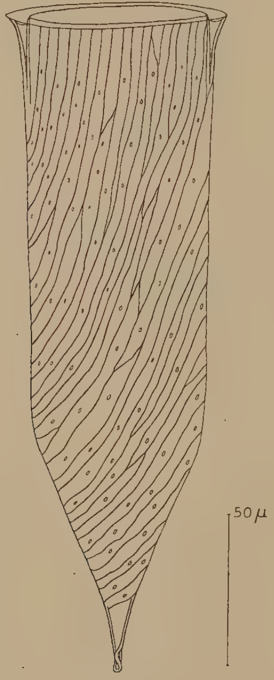


Text-figs. 23–26.—23. *Rhabdonella spiralis*. 24. *R. brandti*. 25. *R. quantula*. 26, 26*a*, 26*b*. *R. amor*.

a great deal of individual variation in the species, and this is confirmed by the Great Barrier Reef material.

The present form agrees well with Brandt's figure of *R. spiralis* var. *indopacifica* and with Jörgensen's *R. spiralis* (1924, fig. 68). It has an oral flare (not always well-marked) and gutter; it is almost cylindrical above and tapering below, and has a long slender pedicel almost half the total length and open at the tip. The striæ run vertically at the top of the bowl and slightly left-handed on its foot. Numerous fenestræ are present between the ribs and the structure of the wall is usually fine.

Dimensions.—Length 266–411μ; length of pedicel 95–224μ; outside diameter of mouth 67–73μ; number of ribs 30–40.



27

Text-fig. 27.—*Rhabdonella spiralis ?*

Rhabdonella spiralis (Fol), Brandt ? Text-fig. 27.

A form found only once, at the weekly station in August, may be a monstrous or a half-developed specimen, such as is described by Jörgensen (1924). The ribs, about 40 in number, run right-handed on the bowl (which is unusual in *Rhabdonella* spp.). There are numerous fenestrae, except just below the mouth. The shape of the bowl resembles that of *R. spiralis*, but it narrows rather abruptly to a short pedicel.

Dimensions.—Total length 215μ; external diameter of mouth 73μ; pedicel 13μ.

Rhabdonella brandti, Kofoid and Campbell. Text-fig. 24.

Ptychocylis (*Rhabdonella*) *amor* var. a *cuspidata*, Brandt, 1906, p. 27; pl. liv, figs. 3, 10, 11; Brandt, 1907, *Rhabdonella amor* var. *cuspidata*, p. 331.
Rhabdonella brandti, Kofoid and Campbell, 1929, p. 213, fig. 400.

Occurrence.—Present throughout most of the year, but was much more abundant after March.

Distribution.—In the warm parts of the Atlantic; the Karajak fjord; the Mediterranean; the Red Sea; off Borneo.

Remarks.—This is a smaller form than the preceding, and shows similar slight variations in size and shape. The ribs usually run vertically, but occasionally show a slight left-handed spiral on the foot of the bowl. The oral flare is little marked. The fenestrae are numerous and distinct.

Dimensions.—Length 158–198μ, usually 170–190μ, of which the pedicel forms from a quarter to a little less than half; external diameter at mouth 60–69μ; about 28–35 ribs, fenestrae numerous.

Rhabdonella quantula, Kofoid and Campbell. Text-fig. 25.

Rhabdonella quantula, Kofoid and Campbell, 1929, p. 218, fig. 402.

Occurrence.—Appeared mostly at stations near the outer reefs, especially in Papuan Pass, but was present at the weekly station in September and October, and once in March.

Distribution.—The Mexican, Californian, South Equatorial, Equatorial Counter and North Equatorial Currents; the Panamic area, Galapagos Eddy and South Equatorial Drift.

Remarks.—This species is like *R. brandti* in general appearance, but is more slenderly built and has a better defined pedicel. Its range of size is greater, but on the whole the specimens are smaller. The ribs are vertical or slightly left-handed, the tip of the pedicel is usually open and fenestrae are often present, although sometimes faint and difficult to see. The ribs are fewer than in Kofoid and Campbell's specimens. It is apparently restricted to more oceanic conditions than *R. brandti* and *R. spiralis*.

Dimensions.—Length 104–172μ; outside diameter at mouth 40–52μ; number of ribs 20–35, usually 30–35.

Rhabdonella amor (Cleve), Brandt. Text-fig. 26.

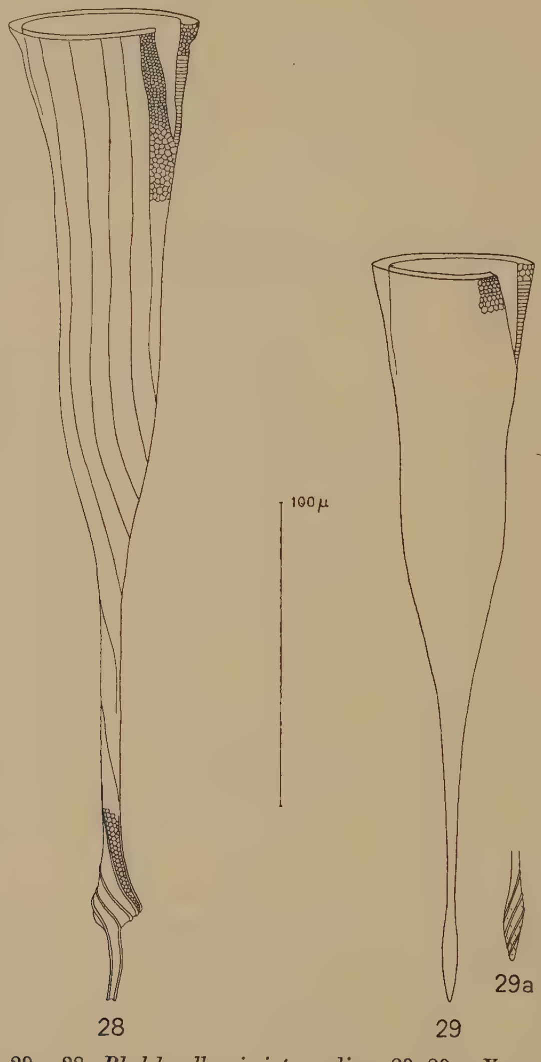
Cittarocylis Amor, Cleve, 1900, pp. 970–971, fig. (4).
Rhabdonella amor, Kofoid and Campbell, 1929, p. 212, fig. 398.

Occurrence.—Present throughout the year at the weekly station, more commonly after March, and also at the stations on the Outer Barrier Reefs.

Distribution.—Widely distributed in the warmer parts of the Atlantic and in the Indian Ocean, the Mediterranean and the Karajak fjord.

Remarks.—This is the smallest of the *Rhabdonella* species in the Great Barrier Reef material. It varies in shape, but the pedicel, although better defined than in Kofoid and Campbell's figure, is not usually so well marked off as in the other species. Text-figs. 26 and 26*b* show variations in shape; the pedicel is sometimes even less marked than in Text-fig. 26. The oral flare is only slight. There are 30–44 ribs, usually running in a left-handed spiral on the foot of the bowl. The fenestrae, when present, are small and sometimes difficult to see. In many specimens the meshes at the oral lip are large (Text-fig. 26*a*), but these rapidly give way to small meshes and the structure over most of the bowl is very fine.

Dimensions.—Length 77–92μ ; external diameter of mouth 45–55μ.



Text-figs. 28, 29.—28. *Rhabdonellopsis intermedia.* 29, 29*a*. *Xystonella lanceolata.*

Rhabdonellopsis intermedia, Kofoid and Campbell. Text-fig. 28.

Rhabdonellopsis intermedia, Kofoid and Campbell, 1929, p. 223, fig. 424.

Occurrence.—Rare. Present at the weekly station in August, September and October, 1928, in March and June, 1929, and at most stations on the outer Barrier. It is thus confined to water of a fairly high salinity.

Distribution.—The Pacific Ocean in the Californian, Mexican, Peruvian and South Equatorial Currents; the Panamic area and Galapagos Eddy.

Remarks.—The genus *Rhabdonellopsis* is widely distributed in warm oceanic waters. It has been divided by Kofoid and Campbell into six species, of which the present forms most closely resemble *R. intermedia*. They resemble also Brandt's *Rhabdonella apophysata* var. *b*, except in the occasional presence of fenestrae, which seems to be a variable character, and in the striae, which are less spirally twisted.

The oral flare is marked; the ribs, 12–17 in number, are almost vertical, showing only a slight left-handed twist on the foot of the bowl and the pedicel. They continue to the knob, where they are often well marked. The pedicel is open at the tip. The development of the knob on the pedicel varies considerably, from a simple knob to a structure 14μ in diameter, with well-marked ribs and secondary mesh-work.

On the bowl the secondary structure is very fine at the oral lip, enlarges on the body to a coarse hexagonal mesh-work, and diminishes again on the pedicel.

Dimensions.—Length 240–370μ (usually 250–300μ); external diameter at mouth 60–75μ; pedicel 116–180μ (usually 116–140μ); fenestrae few and small, not always visible; diameter of knob 9–14μ.

Xystonella lanceolata (Brandt), Brandt. Text-fig. 29.

Cytarotcylis ? (*Xystonella*) *lanceolata*, partim, Brandt, 1906, pp. 7, 24, pl. xlii, fig. 4–7; (*Cyttarocylis ?*) *Xystonella lanceolata*, Brandt, 1907, p. 258.
Xystonella lanceolata, Kofoid and Campbell, 1929, p. 236, fig. 449.

Occurrence.—Rare. Only in August, September and October and at stations on the Great Barrier Reef.

Distribution.—The Atlantic and Indian Oceans; the Mediterranean.

Remarks.—This species is rather variable in form. The oral flare is sometimes present and sometimes not. The pedicel is always more refractive than the very delicate upper part of the lorica, and stands out from it clearly. The secondary mesh-work, always visible in these specimens as in Jörgensen's (1924), is very small near the mouth, large over the greater part of the bowl and diminishes towards the pedicel. On this, when visible, the meshes are longer in shape. The pedicel is usually enlarged into a spindle-shaped swelling near the foot, on which the ribs run diagonally (Text-fig. 29*a*) or form a mesh-work, but occasionally the swelling shows no structure, and it may be entirely absent.

Dimensions.—Length 215–275μ; external diameter of mouth 53–60μ; pedicel 65–95μ.

Xystonella treforti (Daday), Laackmann.

Cyttarocylis Treforti, Daday, 1887, p. 597, pl. xxi, fig. 1.
Xystonella treforti, Kofoid and Campbell, 1929, p. 238, fig. 452.

Occurrence.—Very rare. In Papuan Pass, and off Lizard Island, in February, and once at the weekly station in March.

Distribution.—Mediterranean, Atlantic, Indian and Pacific Oceans.

Remarks.—This is a larger species than the last, and agrees well with Brandt's description and figure (Brandt, 1906, pl. xlviii, fig. 1).

Dimensions.—Length 405–469μ; external diameter of mouth 76–80μ; greatest diameter of body 75–86μ.

Undella hemispherica, Laackmann. Text-fig. 30.

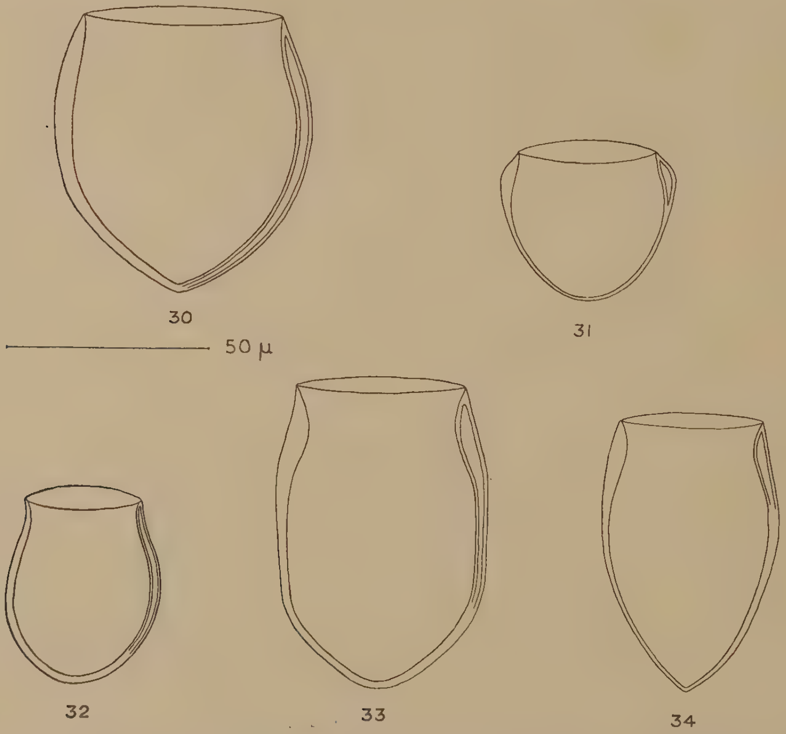
Undella hemispherica, Laackmann, 1910, pp. 468, 471, 472–3, 493, pl. xlix, fig. 22.
Undella hemispherica, Kofoid and Campbell, 1929, p. 263, fig. 505.

Occurrence.—Very rare. In October and March at the weekly station and off Lizard Island in February.

Distribution.—The tropical Atlantic.

Remarks.—This rare form resembles a *Proplectella*, but has no thickening of the wall to form an inner collar, and is almost as wide as long. A fine primary reticulation can be made out, especially near the mouth.

Dimensions.—Length 65–69μ ; diameter at mouth 47–53μ ; greatest width 62–65μ.



Text-figs.—30–34.—30. *Undella hemispherica*. 31. *U. turgida*. 32. *Proplectella perpusilla*. 33. *P. tenuis*. 34. *P. acuta*.

Undella turgida, Kofoid and Campbell. Text-fig. 31.

Undella turgida, Kofoid and Campbell, 1929, p. 266, fig. 502.

Occurrence.—Very rare. One specimen seen from the catch off Lizard Island in February.

Distribution.—The eastern tropical Pacific.

Remarks.—The single specimen seen agreed exactly with Kofoid and Campbell's figure except that it was slightly smaller and had a distinct reticulation, the meshes being small at the oral lip, and slightly larger at the widest part of the bowl.

Dimensions.—Length 37μ ; diameter at mouth 35μ.

Proplectella tenuis, Kofoid and Campbell. Text-fig. 33.

Undella claparèdei var. c, Brandt, 1906, p. 31, pl. lxiv, figs. 5, 6, 7; 1907, pp. 348, 349, 363, 364.
Proplectella tenuis, Kofoid and Campbell, 1929, p. 283, fig. 536.

OCCURRENCE.—Rare except from February till May and at stations on the outer barrier. It was then present only in small numbers.

DISTRIBUTION.—The tropical Atlantic; the Indian Ocean south of Madagascar.

REMARKS.—This was the commonest species of the genus *Proplectella* in the Great Barrier Reef material. The lorica is ovate, expanding below the mouth to its widest at about a third of the length from the mouth. The sides are slightly flattened, and the aboral end is usually rounded, sometimes slightly angular. A fine reticulation can be made out in most specimens.

DIMENSIONS.—Length 69–76μ; diameter at mouth 40–45μ; greatest width 49–56μ.

Proplectella perpusilla, Kofoid and Campbell. Text-fig. 32.

Proplectella perpusilla, Kofoid and Campbell, 1929, p. 281, fig. 524.

OCCURRENCE.—Very rare. In March and April at the weekly station.

DISTRIBUTION.—The Galapagos Eddy and widely in the eastern tropical Pacific.

REMARKS.—This is a smaller form than the last and is widest in the expanded aboral half. Only a few specimens were seen.

DIMENSIONS.—Length 47–49μ; diameter at mouth 27–30μ; greatest width 37–38μ.

Proplectella acuta (Jörgensen). Text-fig. 34.

Undella subacuta forma *acuta*, Jörgensen, 1924, pp. 39–41, fig. 43*a*.
Proplectella acuta, Kofoid and Campbell, 1929, p. 273, fig. 545.

OCCURRENCE.—Very rare. In October at the weekly station.

DISTRIBUTION.—The Mediterranean.

REMARKS.—This species differs from the others in the genus in its acutely pointed aboral end. The wall is much thinner in the aboral than in the oral half. Only a single specimen was seen.

DIMENSIONS.—Length 65μ; diameter at mouth 38μ; greatest diameter 47μ.

Dictyocysta reticulata, Kofoid and Campbell.

Dictyocysta Templum, Daday, 1887, p. 585, pl. xxi, figs. 8, 9.
Dictyocysta reticulata, Kofoid and Campbell, 1929, p. 300, fig. 560.

OCCURRENCE.—Rare. Found at the weekly station in March, April and May, and in samples from Trinity Opening and Papuan Pass.

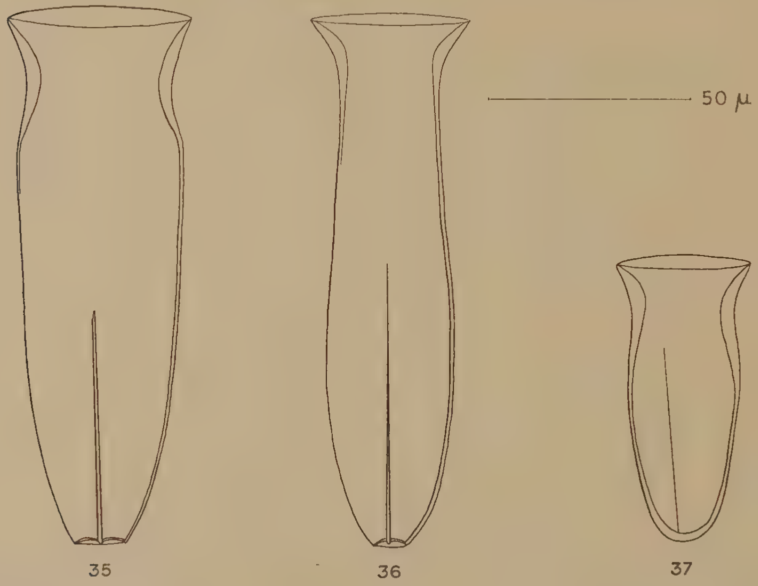
DISTRIBUTION.—The Mediterranean; the Indian Ocean; the eastern tropical Pacific.

REMARKS.—There is a good figure of this species in Brandt (1906, pl. iii, fig. 8). The collar is a little more than a third of the whole length, and the bowl is widest just below the collar and is bluntly pointed aborally. There are usually 6, but occasionally 7, large angular windows in the collar. A little below the widest part of the bowl there are usually two circles of fenestrae. Sometimes, however, only one circle is present, and occasionally there are no fenestrae at all. The number in each circle is variable, the top one having 6 to 9, and the lower usually only 2 or 3, smaller and less regular. This lower incomplete circle is not mentioned by Kofoid and Campbell, although there is an indication of it in Brandt's fig. 8 and in Daday's fig. 8. The rest of the bowl is made up of very regular polyhedral reticulations. One specimen showed very small projections all along the oral margin of the collar.

Dimensions.—Total length 58–65μ ; diameter at mouth 37–43μ ; height of collar 20–25μ ; length of bowl 34–45μ ; greatest width of bowl 43–48μ.

Amphorella quadrilineata (Claparède and Lachmann), Daday. Text-fig. 35.

Tintinnus quadrilineatus, Claparède and Lachmann, 1858, p. 201, pl. ix, fig. 3.
Amphorella quadrilineata, Kofoid and Campbell, 1929, p. 311, fig. 587.



Text-figs. 35–37.—35. *Amphorella quadrilineata*. 36. *A. brandti*. 37. *A. minor*.

Occurrence.—Present throughout the year and was common in February and March.

Distribution.—Has a wide distribution in northern temperate waters, as well as in the Mediterranean and the warm parts of the Atlantic, Indian and Pacific Oceans.

Remarks.—This species has three well-marked fins, which run from the aboral end up towards the mouth. Their length is variable ; usually they extend half or two-thirds of the way up, but they occasionally run right-up to the mouth. The lorica narrows, and its wall is much thickened just below the mouth. It is widest in the upper third, a little below the neck, and narrows gradually to a truncated tip. Although this thickening of the wall of the lorica is very characteristic, it varies considerably and may occasionally be quite absent.

Dimensions.—Total length 108–145μ (usually over 130μ) ; diameter at mouth 45–54μ ; diameter at neck 37–43μ ; greatest diameter of body 38–43μ.

Amphorella brandti, Jörgensen. Text-fig. 36.

Tintinnus amphora, Brandt, 1906, p. 33, pl. lxix, fig. 6; 1907, partim, pp. 433–434.
Amphorella brandti, Kofoid and Campbell, 1929, p. 309, fig. 588.

Occurrence.—Present throughout the year and was common in February and March.

Distribution.—The Atlantic; Mutsu Bay in Japan.

Remarks.—This species is a more slender form than the preceding, flares more towards the mouth and is usually rather longer. Although the dimensions of the oral part remain pretty constant, the length varies considerably. Three fins are present, as in the last species. The lorica is widest in its lower third, and then narrows to a truncated tip. No primary or secondary structure was ever visible.

Dimensions.—Total length 107–190μ (usually 130–160μ); diameter at mouth 38–45μ; diameter at neck 22–28μ; greatest diameter of body 29–35μ.

Amphorella laackmanni, Jörgensen.

Tintinnus amphora var. *dadayi*, Laackmann, 1910, pp. 486–487, 493, pl. l, fig. 12.
Amphorella laackmanni, Kofoid and Campbell, 1929, p. 310, fig. 591.

Occurrence.—Very rare. Off Lizard Island in February, and at the weekly station in March.

Distribution.—The Mediterranean; the tropical Atlantic.

Remarks.—The few specimens seen were longer than Jörgensen's (1924, p. 19, fig. 14) from the Mediterranean (from the stomach of Salps), but agree with his description otherwise. The four ribs from the oral end do not join up with the four from the aboral end.

Dimensions.—Length 75–84μ; diameter at mouth 20–22μ.

Amphorella minor, Jörgensen. Text-fig. 37.

Amphorella quadrilineata var. *minor*, Jörgensen, 1924, p. 18, figs. 12*a* and 12*b*.
Amphorella minor, Kofoid and Campbell, 1929, p. 310, fig. 590.

Occurrence.—Very rare. In September and October, 1928, and in July, 1929, at the weekly station.

Distribution.—The Mediterranean and the eastern Pacific.

Remarks.—Apart from its small size and the fact that it has a rounded instead of a truncated end, this species is very like *A. quadrilineata*. It thus resembles Jörgensen's drawing rather than Kofoid and Campbell's, which is more like a small *A. brandti*.

Steenstrupiella steenstrupii (Claparède and Lachmann).

Tintinnus Steenstrupii, Claparède and Lachmann, 1858, p. 200, pl. viii, fig. 5.
Steenstrupiella steenstrupii, Kofoid and Campbell, 1929, p. 314, fig. 596.

Occurrence.—Rare. In September, October, November, March and April at the weekly station, and in Trinity Opening in November.

Distribution.—Widely distributed in the Mediterranean, Atlantic and Indian Oceans.

Remarks.—This species is very variable, both in length and in thickness of wall. There is a marked oral flare and sub-oral thickening. The wall of the lorica is usually thick for about two-thirds of the length, but thins out at the aboral end. No striae were visible on about half the specimens, but they were quite clear on the rest.

In general appearance this form agrees with *S. robusta*, Kofoid and Campbell, but occasionally the wall was quite thin, even at the neck (*cf. Amphorella quadrilineata*), and all gradations were found between this and the usual condition. There was no relation between size or presence of striae and thickness, so I prefer to identify all specimens as *S. steenstrupii*. As usual in the family Tintinnidae, the width of the mouth, neck and body generally is much more constant than the total length.

Dimensions.—Length 84–197μ ; diameter at mouth 34–37μ ; diameter at neck 20–24μ ; greatest diameter 13–19μ.

Steenstrupiella intumescens (Jörgensen).

Amphorella intumescens, Jörgensen, 1924, p. 21, fig. 19.
Steenstrupiella intumescens, Kofoid and Campbell, 1929, p. 313, fig. 594.

Occurrence.—Rare. It was seen only in March at the weekly station.

Distribution.—The Mediterranean.

Remarks.—The lorica is long and narrow, with a flaring mouth and a rounded aboral end. Four striae or fins extend from about the middle to the aboral end. In the two specimens described by Jörgensen there was a marked thickening of the wall in the middle of the lorica, which merged gradually into the thin-walled parts above and below. In the present material this thickening is absent in some specimens. The oral end differs from all others in the genus by the complete lack of a sub-oral thickening of the wall.

Dimensions.—Length 172–238μ ; diameter at mouth 34–37μ ; diameter of body in the middle 17–21μ ; length of fins 77–90μ.

Amphorellopsis acuta (Schmidt).

Amphorella acuta, Schmidt, 1902, p. 184, figs. 2*a–c*.
Amphorellopsis acuta, Kofoid and Campbell, 1929, p. 315, fig. 598.

Occurrence.—Rare. At the weekly station in September, October, November, February and March, and off Lizard Island and in Papuan Pass in February.

Distribution.—The Gulf of Siam ; the West African coast.

Remarks.—This species is very like *Amphorella brandti*, except that it is smaller in all dimensions and has a pointed, not a truncated, aboral end. The thickness of the wall is variable.

Dimensions.—Length 76–89μ ; diameter at mouth 29–37μ ; diameter of neck 19–24μ ; greatest diameter of body 22–27μ.

Four longer specimens were seen. Their dimensions were : Length 116–121μ ; diameter at mouth 34–36μ ; diameter of neck 19–25μ ; greatest diameter of body 26–30μ.

Dadayiella ganymedes (Entz Sr.), Kofoid and Campbell.

Tintinnus Ganymedes, Entz Sr., 1884, p. 409, pl. xxiv, figs. 17, 18.
Dadayiella ganymedes, Kofoid and Campbell, 1929, p. 321, fig. 610.

Occurrence.—Rare until November, and was usually present at the weekly station thereafter.

Distribution.—The Mediterranean; widely distributed in the Atlantic; the Indian and Pacific Oceans.

Remarks.—A very delicate species. The ribs number 7–12 and there are sometimes subsidiary shorter ribs between these. None of them extend below the widest part of the bowl. Occasionally the wall of the lorica at the mouth appears to have been destroyed and the ribs are seen sticking out. No marking was observed on the thin-walled pedicel, which is straight and sharply pointed. The length is less than that of the specimens described by Entz from the Mediterranean, and Brandt from the Atlantic. Apart from this, and the lack of ribs on the pedicel, the specimens resemble Brandt's pl. lxx, fig. 2.

Dimensions.—Total length 75–95μ; diameter at mouth 29–30μ; greatest width of bowl 28–30μ; length of pedicel 13–17μ.

Tintinnus attenuatus, Kofoid and Campbell. Text-fig. 38.

Tintinnus lusus-undae var. c, Brandt, 1906, partim, p. 32, pl. lxv, fig. 12; 1907, p. 422, *Tintinnus fraknoi* var. c, 1906, p. 32, pl. lxv, fig. 20; 1907, partim, p. 424.
Tintinnus attenuatus, Kofoid and Campbell, 1929, p. 332, fig. 633.

Occurrence.—Present throughout most of the year except from April to June, but not so common as *T. lusus-undae*.

Distribution.—The Mediterranean; the tropical Atlantic; the Indian Ocean off Madagascar; the western Pacific.

Remarks.—This species agrees well with Brandt's *T. fraknoi* var. c, which has been divided by Kofoid and Campbell between two species, *T. attenuatus* and *T. macilentus*. I have put the present form in the first of these, since it agrees more closely in size, but it usually possesses a slight aboral flare—a feature which, according to Brandt's description (1907, p. 424), was usually present, but might be little marked. This is, however, a variable character (*cf. T. lusus-undae*). The oral funnel is not marked, for the flare is gradual, and it thus resembles Brandt's pl. lxv, fig. 20, rather than pl. lxv, fig. 12. Text-figs. 38 and 38*a* show two specimens with the aboral flare more marked in one than in the other.

The diameter of both oral and aboral end is less than in other similar species (*T. fraknoii*, Daday, *T. elongatus*, Jörgensen).

Dimensions.—Length 228–410μ (usually 320–400μ); diameter at mouth 52–57μ; aboral diameter 17–29μ.

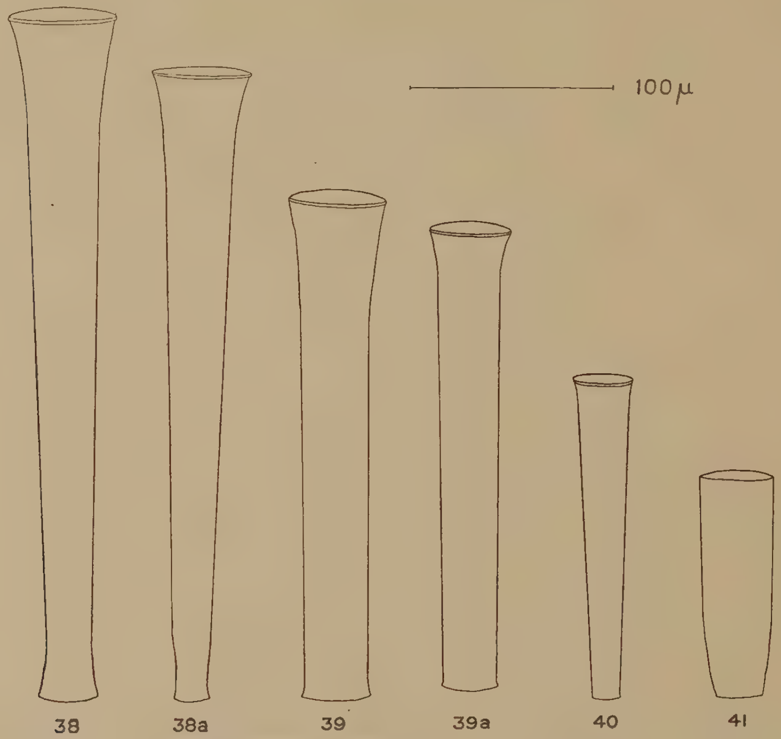
Tintinnus lusus-undae, Entz Sr. Text-fig. 39.

Tintinnus Lusus-undae, Entz Sr., 1885, p. 202, pl. xiv, fig. 12.
Tintinnus lusus-undae, Kofoid and Campbell, 1929, p. 335, fig. 656.

Occurrence.—Present throughout the year and common in August.

Distribution.—The Mediterranean; the tropical Atlantic and the Indo-Pacific region.

Remarks.—Like the rest of the family Tintinnidae, the diameter of this species varies within rather narrow limits, while the length varies considerably. The shape is also variable. The lorica has the form of an open tube, wider at the oral than at the aboral end, but the amount of oral flare varies; there is sometimes a marked brim at the oral edge; the aboral end is usually straight, but there is sometimes a slight flare.



Text-figs. 38–41.—38, 38*a*. *Tintinnus attenuatus*. 39. *T. lusus-undae*. 39*a*. *T. lusus-undae* (slender form). 40. *T. stramentus*. 41. *T. pacificus*.

Fifty specimens were measured and it was found that the measurements fell into two groups. Within each group the total length, the presence or absence of a brim and the amount of oral and aboral flare were equally variable, but one group (Text-fig. 39*a*) was more slender than the other (Text-fig. 39). It is possible that a second species is present (perhaps *T. tenue*, Kofoid and Campbell), but in view of the resemblances otherwise and the fact that a few intermediate specimens were found the two forms are at present kept as one species. The dimensions of the wider form agree well with those of *T. lusus-undae* from elsewhere.

Dimensions.—Wide form: Length 176–298μ; diameter at mouth 51–59μ (usually 52–54μ); diameter at foot 29–35μ (usually 30–33μ); diameter across middle of body 35–43μ (usually 38–39μ).

Slender form: Length 155–277μ; diameter at mouth 34–46μ (usually 43–45μ); diameter at foot 24–29μ (usually 24–27μ); diameter across middle of body 29–33μ (usually 30–32μ).

Intermediate forms: Length 183–191μ; diameter at mouth 47–49μ; diameter at foot 29–30μ; diameter across middle of body 34μ.

Tintinnus stramentus, Kofoid and Campbell. Text-fig. 40.

Tintinnus stramentus, Kofoid and Campbell, 1929, p. 339, fig. 635.

Occurrence.—Appeared occasionally throughout the year, but was not seen after February.

Distribution.—The California Current; the Mexican Current; the Panamic area and South Equatorial Drift of the Pacific.

Remarks.—This species is like a small and slender *T. attenuatus*, but it lacks the oral flare and has only a well-marked brim. The aboral end has usually a very slight flare, but this is sometimes lacking. The sides are straight. Of the specimens measured, several are considerably shorter than the rest, but since the oral dimensions and general shape are the same, they also probably belong to this species.

Dimensions.—Typical: Length 142–176μ; oral diameter 30–31μ; aboral diameter 13–16μ. Others: Length 101–129μ; oral diameter 26–31μ; aboral diameter 11–19μ.

Tintinnus pacificus, Kofoid and Campbell. Text-fig. 41.

Tintinnus pacificus, Kofoid and Campbell, 1929, p. 337, fig. 632.

Occurrence.—Very rare. Occurred in November at the weekly station.

Distribution.—The eastern Pacific, in the South Equatorial Drift.

Remarks.—The few specimens seen were longer than Kofoid and Campbell's specimens, but agree well in general shape. The lorica is almost cylindrical in the oral half or two-thirds, and then usually contracts to an aboral opening about two-thirds the diameter of the oral opening.

Dimensions.—Length 108–120μ; diameter at mouth 33–43μ; diameter at foot 22–27μ.

Tintinnus apertus, Kofoid and Campbell.

Tintinnus inquilinus, Claparède and Lachmann, 1858, pp. 196–198, pl. viii, fig. 2.
Tintinnus apertus, Kofoid and Campbell, 1929, p. 331, fig. 648.

Occurrence.—Present at the weekly station from October to April. It is a neritic form, and appears when the other neritic species, *Tintinnopsis* spp. and *Codonellopsis ostenfeldii* are at their commonest.

Distribution.—The coast of Norway; the Mediterranean; the eastern Pacific.

Remarks.—This species is often seen attached to *Chaetoceros* spp. and is figured thus by Daday (1887), but in the Great Barrier Reef material it was always free. It is almost cylindrical in the upper three-quarters or four-fifths of the lorica, and then narrows to an opening about half the width of the mouth.

Dimensions.—Length 85–103μ; oral diameter 28–32μ; aboral diameter 15–17μ.

Daturella luanae, n. sp. Text-fig. 42.

Occurrence.—In Trinity Opening and at the weekly station in November, 1928.

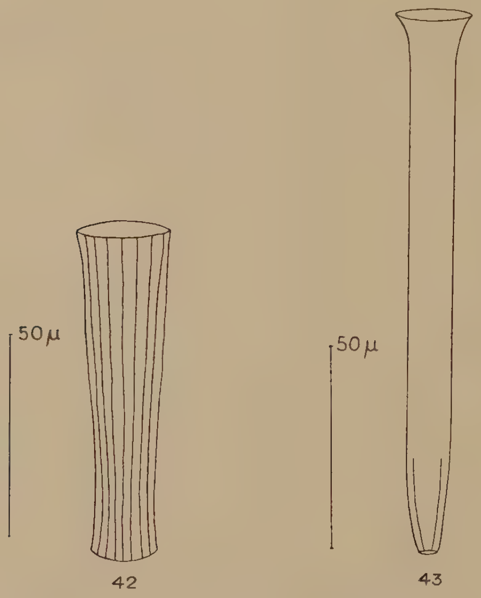
Distribution.—The Great Barrier Reef region.

Description.—The length is about three times the oral diameter. The lorica is thin and easily distorted, but in a normal specimen it is almost cylindrical in the upper half and then contracts slightly in the lower half. There is a slight oral flare. There are about 14 striae, running vertically from the oral to the aboral end.

It differs from all other species of the genus *Daturella* in its much smaller size.

The species is named after the "Luana", the yacht from which most of these hauls were made.

Dimensions.—Length 72–91μ; diameter at mouth 22–31μ (usually 26μ); aboral diameter 15–18μ.



Text-figs. 42, 43.—42. *Daturella luanae*. 43. *Salpingella subconica*.

Salpingella subconica, Kofoid and Campbell. Text-fig. 43.

Salpingella subconica, Kofoid and Campbell, 1929, p. 355, fig. 676.

Occurrence.—Rare. Occasional during the year, but not seen after April.

Distribution.—The eastern Pacific; in the Galapagos Eddy; the Mexican and Peruvian Currents; the Panamic area and the South Equatorial Drift.

Remarks.—Only a few specimens of this rare species were seen in the tow-nettings. It is probably slender enough to slip through the meshes of the net.

It has a flaring mouth and a long cylindrical body contracting aborally to a narrow opening. Six fins are visible on the contracted aboral end.

Dimensions.—Length 97–131μ; oral diameter 16–18μ; aboral opening about 4μ.

Table I.

	Weekly Station.																										Position.				
																											Trinity Opening.	Trinity Opening.	Cape Bedford.	Lizard Island.	Papuan Pass.
h	Aug.		Sept.		Oct.		Nov.		Dec.		Jan.			Feb.		Mar.			Apr.		May.		June.		July.		Aug.	Nov.	Feb.	Feb.	Feb.
on number	3	6	10	13	15	18	23	25	32	35	37	38	39	41	42	47	48	51	53	55	57	58	61	63	64	67	8	26	43	44	49
ptintinnus nordqvisti		+			+			c	+	+			+			+	c	c					+			+			+	+	
nnopsis compressa		+	+			+		+	+		+					c	+	c					+		+				+	f	
ortensenii					+	+		c	+				+			+	+	c			+		+	+				+		+	
tundata	+	+		+	+	+	+	+	+	+			f	+		+	+	c	+	+	+	+	+	+	+	+		+	+	+	+
acilis	+	+	+		+	+		c	+		+	+	+	+		+	+	c	+	+	+	+	+	+	+			+	+	+	+
dix			+		+			c	+	+			+			+	+	c	+	+	+		+	+	+	+			+	+	
lindrica		+	+		+	+		c				+	+		+	+	c	c					+	+				+		+	
cantinensis																+	+	+		+										+	
semella nivalis						+										+			+											+	
nellopsis ostenfeldii	c	c	+	+	+	+		c	+	+	c	c	+	+	+	+	+	c	c	f		+	+	c	f	+	+	+	+	+	+
dica			+	+		+	+		+	+			+	+	+	+	+	+		f					f	+	+	+		+	+
rvicollis	+	+	+		+	+	+		+	+	+	+	+	+	+	+	+	+		f	+			+	+	+	+	+		+	+
evicaudata																														+	
acocylis scalaria																															+
alaroides				+			+						+	+		+											+	+			+
ella laciniosa																+															+
lla azorica			+				+		+											+						+		+		+	
locylis ralumensis																+														+	
aldi	+	+	+	+		+	+		+	+	+		+		+	+	+			+	f	+	+	+	+	+	+	f		+	f
nstricta	+																														
igua																											+				
anda															+	+	+													+	+
ndella				+												+	+													+	+
flexa																+															+
rella aperta													+			+														+	+
cylis corbula									+							+														+	
rhabdonella simplex	+	+	+			+		+		+											c	f	+	f	c	f					
rta																+			+						+					+	
donella spiralis	+	+	+	+	+	c	+	+					+			+	+	+	+	f	f	+	+	+	+	f	+	+	+	+	
randti		+	+			+	+									+	+	+	+	f	f	+	c	+	c	f		+	+		+
antula			+		+	+										+	+	+												+	+
nor	+	+		+		+	+	+		+			+	+	+	c	+	+	f	f	f	+	+		+	f		f	+	+	f
donellopsis intermedia	+		+	+		+										+	+						+				+			+	+
onella lanceolata	+		+			+																					+				
eforti																+														+	+
lla hemispherica						+										+														+	
rgida																														+	
lectella tenuis						+									+	+	+		+	+	+	+					+			+	f
erpusilla																+			+												
cuta						+																									
ocysta reticulata																+			+	+	+						+				+
horella quadrilineata	+	+	+		+	+				+		+	c	f	c	c	+		+	+			+		+	+		+	+	+	+
randti	+		+		+	+		+		+	+		c	f	c	c	+	+		+		+			+		+			+	+
ackmanni																+														+	
inor			+			+																				+					
strupiella steenstrupii			+			+	+									+				+								+			
tumescens																+															
horellopsis acuta				+		+	+							+	+	f		+												+	+
yiella ganymedes	+					+	+	+	+	+	+	+	+	+	+	c	+	+	+	+		+	+	+	+	+		+	+	+	+
innus attenuatus			+			+		+	+	+		+	+	+	+	f	+								+	+			+	+	+
usus-undae	+	+	+	+		+				+		+	f	+	+	f	+	+	f	+		+	+	+	+	f	+	+	+	+	+
ramentus	+	+	+		+	+		+	+		+			+		+												+		+	+
acificus							+																								
pertus						+	+		+			+		+	+	f	+	+		+									+	+	
rella luanae							+																					+			
ingella subconica				+				+												+								+			

+ = Present, but not in large numbers. f = frequent. c = Common.

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INDEX

(The principal references are in heavy type.)

PAGE
Acantharia 625
Acanthodesmidae 624
acuta, Amphorella 656
acuta, Amphorellopsis 633, **656**, 661
acuta, Proplectella 633, 652, **653**, 661
americana, Codonellopsis 639
amor, Cittarocylis 649
amor, Rhabdonella 633, 647, **649**, 661
amor, var. a, cuspidata, Ptychocylis (Rhabdonella) 649
amor, var. cuspidata, Rhabdonella 649
amphora, Tintinnus 655
amphora, var. dadayi, Tintinnus 655
ampla (?), var. a, laciniosa, Cyttarocylis ? (Coxliella) 642
aperta, Craterella 633, **645**, 661
aperta, var. a, Tintinnopsis 638
apertus, Tintinnus 633, **659**, 661
apophysata, var. b, Rhabdonella 651
attenuatus, Tintinnus 633, **657**, 658, 659, 661
azorica, Favella 633, 641, **642**, 661
azorica, Undella 642

beroidea, Tintinnopsis 635
beroidea, var. compressa, Tintinnopsis 634
bioctonaria, Mesocena 631
blanda, Epiplocylis 633, **644**, 661
brandti, Amphorella 633, 654, **655**, 656, 661
brandti, Rhabdonella 633, 647, **649**, 661
brevicaudata, Codonella 640
brevicaudata, Codonellopsis 632, **640**, 661

calyx, var. b, Ptychocylis 643
Chaetoceros 659
claparèdei, var. c, Undella 653
Climacocylis 640
Codonellidae 632
Codonellopsidae 632
Codonellopsis 633
composita, Favella 642
compressa, Tintinnopsis 632, **634**, 635, 661
constricta, Epiplocylis 633, **643**, 661
corbula, Metacylis 633, 645, **646**, 661
Coxliellidae 632
Craterella 645

PAGE
curta, Protorhabdonella 633, **646**, 661
curvicauda, Tintinnopsis 636
cylindrica, Tintinnopsis 632, **637**, 661
Cyttarocylidae 633

Daturella 660
Davidoffi, var. cylindrica, Tintinnopsis 637
deflexa, Epiplocylis 633, 643, 644, **645**, 661
Dictyocha 624, 625, 628, 629, 630
Dictyocystidae 633
Distephanus 624, 625, 626, 627, 628, 629

elongatus, Tintinnus 657
Epiplocylis 633, 644
exigua, Epiplocylis 633, **643**, 644, 661

Favella 642
fibula, Dictyocha 625, 626, 627, 628
fibula, var. hexagona, Dictyocha **629**, 630
fibula, var. pentagona, Dictyocha 630
fibula, var. stapedia, Dictyocha **629**
fracta, Tintinnopsis 636, 637
fraknoii, Tintinnus 657
fraknoi, var. c, Tintinnus 657

ganymedes, Dadayiella 633, **657**, 661
ganymedes, Tintinnus 657
gracilis, Tintinnopsis 632, **636**, 661

healdi, Epiplocylis 633, **643**, 644, 661
hemispherica, Undella 633, **652**, 661
hexacantha, Dictyocha 630

indica, Codonellopsis 632, **639**, 661
inquilinus, Tintinnus 659
intermedia, Rhabdonellopsis 633, **650**, 651, 661
intumescens, Amphorella 656
intumescens, Steenstrupiella 633, **656**, 661

karajacensis, var. a, Tintinnopsis 636
kofoidi, Tintinnopsis 638

laackmanni, Amphorella 633, **655**, 661
labiosa, Epiplocylis 643
laciniosa, Coxliella 632, **642**, 661

PAGE
laciniosa, Cyttarocylis ? (Coxliella) 642
lanceolata, Cyttarocylis ? (Xystonella) 651
lanceolata (Cyttarocylis ?), Xystonella 651
lanceolata, Xystonella 633, 650, **651**, 661
Leprotintinnus 633
luanae, Daturella 633, **660**, 661
lusus-undae, Tintinnus 633, **657**, 658, 661
lusus-undae, var. c, Tintinnus 657

macilentus, Tintinnus 657
Mastigophora 624
minor, Amphorella 633, 654, **655**, 661
morchella, Codonella 639
mortensenii, Tintinnopsis 632, **635**, 661

nivalis, Stenosemella 632, **638**, 661
nordqvisti, Leprotintinnus 632, **634**, 661
nordqvisti, Tintinnopsis 634
nucula, Tintinopsis 634

orientalis, Codonellopsis 639
ostenfeldi, Codonellopsis 638
ostenfeldii, Codonella 638
ostenfeldii, Codonellopsis 632, **638**, 639, 659, 661
ovalis, Dictyocysta 640

pacificus, Tintinnus 633, 658, **659**, 661
parvicollis, Codonellopsis 632, 639, **640**, 661
perpusilla, Proplectella 633, 652, **653**, 661
Petalotrichidae 633
Phaeodaria 624
polymorpha, var. bioctonaria, Mesocena 631
polymorpha, var. hexagona, Mesocena 630
Proplectella 633, 642, 652, 653
Ptychocylidae 633

quadrilineata, Amphorella 633, **654**, 655, 656, 661
quadrilineata, var. minor, Amphorella 655
quadrilineatus, Tintinnus 654
quantula, Rhabdonella 633, 647, **649**, 661

Radiolaria 624, 625
radix, Codonella 636
radix, Tintinnopsis 632, **636**, 637, 638, 661
ralumensis, Epiplocylis 633, **642**, 661
reticulata, Dictyocysta 633, **653**, 661
reticulata, Epiplocylis 643
reticulata, var. ralumensis, Ptychocylis 642
Rhabdonellidae 633
Rhabdonellopsis 651

PAGE
robusta, Steenstrupiella 656
rotundata, Tintinnopsis 632, **635**, 661

scalaria, Climacocylis 632, 633, **640**, 642, 661
scalarius, Cyttarocylis (Coxliella) 640
scalarius, var. a, Cyttarocylis 641
scalaroides, Climacocylis 632, 633, **641**, 642, 661
simplex, Cyttarocylis 646
simplex, Protorhabdonella 633, **646**, 661
speculum, Distephanus 624, 625, 626, 630, 632
speculum, forma pseudo-fibula, Distephanus 630
speculum, var. bioctonarius, Distephanus **631**
speculum, var. octonarius, Distephanus 631, 632
spiralis, Rhabdonella 633, **646**, 647, 648, 649, 661
spiralis ?, Rhabdonella **648**
spiralis, var. c, indopacifica, Ptychocylis (Rhabdonella) 646
spiralis, var. c, indopacifica, Rhabdonella 646
spiralis, var. indopacifica, Rhabdonella 648
steenstrupii, Steenstrupiella 633, **655**, 656, 661
steenstrupii, Tintinnus 655
stramentus, Tintinnus 633, 658, **659**, 661
striata, forma β, curta, Cyttarocylis 646
subacuta, forma acuta, Undella 653
subconica, Salpingella 633, **660**, 661

Templum, Dictyocysta 653
tenue, Tintinnus 658
tenuis, Proplectella 633, 652, **653**, 661
tenuis, Tintinnopsis 635
Tintinnidae 633, 636, 658
Tintinnididae 632
Tintinnopsis 633, 659
tocantinensis, Tintinnopsis 632, **638**, 661
Treforti, Cyttarocylis 651
treforti, Xystonella 633, **651**, 661
turgida, Undella 633, **652**, 661

Undella 633
Undella, Cittarocylis 645
undella, Epiplocylis 633, 643, 644, **645**, 661
undella, var. blanda, Epiplocylis 644
undella, var. b, Ptychocylis 645
undella, var. c, Ptychocylis 643
Undellidae 633

ventricosa, Codonella 638

Xystonella 633
Xystonellidae 633

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